GENERAL SCIENCE SYLLABUS

For Classes I – VIII

(Experimental Edition)

NATIONAL COUNCIL OF EDUCATIONAL RESEARCH & TRAINING
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PREFACE

Purpose of the Syllabus

Since universal education in India presently extends through the primary schools, it is paramount that there should be included in the primary schools those ideas and approaches of science essential for the future citizens to live well-ordered lives in a rapidly developing technological society. The elementary school should extend the pupil's orientation in the sciences enabling him to make wise decisions as a participant in a democratic society, and laying for him a proper foundation for the study of science in the secondary school.

Such a foundation is essential not only for the science students but also for those who will pursue the humanities and perhaps become teachers in the primary schools. For the science students, the future scientists of India, a sound foundation in science in the primary and middle schools enables them to make rapid progress if they are to become successful scientists.

The lives of each of us are touched every day by the forces of change. Much of this change is due to the impact of science. As the nature of the world is becoming increasingly determined by science and technology, it is certain that every individual needs some understanding of science to comprehend the world, and live in it intelligently. India's progress depends upon how successfully her citizenry comprehend the basic principles of science and appreciate what science has to offer in the improvement of health and living conditions and in the promotion of agriculture and industry.

The Objectives of Teaching General Science

The objectives of teaching science at the primary and middle school levels may be outlined as follows :

1. To acquire knowledge of
   (a) biological environment ;
   (b) physical environment ; and
   (c) material environment including forces of nature and simple natural phenomena.

2. To develop scientific attitudes such as :
   (a) objective outlook ;
   (b) spirit of enquiry ;
   (c) truthfulness and integrity ;
   (d) initiative ;
   (e) inventiveness ;
   (f) accuracy and precision ;
   (g) avoiding hasty conclusions, or conclusions on insufficient data ; and
   (h) respect for the opinion of others.

3. To develop skills, such as :
   (a) problem solving skills ;
      (i) observing facts and phenomena ;
      (ii) locating a problem ;
      (iii) designing procedures for solving problems ;

(iv) recognising and organising data ;
(v) reasoning from data ; and
(vi) drawing conclusions and holding data tentative in the light of new evidence.

(b) manipulative skills ;
(i) collecting, classifying and tabulating data, and computing results ; and
(ii) handling and setting up apparatus and reading instruments.

(c) application of knowledge to life situations.

4. To develop personal habits, such as :
(a) right health habits ;
(b) efficient working skills ;
(c) habit of quantitative thinking ; and
(d) habit of inquiry.

5. To develop appreciations, such as .
(a) the impact of science on life ;
(b) contribution of scientists ;
(c) the vastness of space ;
(d) limitlessness of time ;
(e) simple natural phenomena ;
(f) interdependence of life (plants and animals) ;
(g) dependence of living things on physical environment and adaptation ; and
(h) modification of environment by living things.

6. To develop interests, such as .
(a) collection of materials of information in various ways ;
(b) useful hobbies like photography, gardening, animal and bee keeping, making models, apparatus, maintaining weather charts, etc. ; and
(c) reading of articles regarding the development and applications of science to daily life.

Guide Lines to Follow in Achieving the Above Objectives

A child should learn from his earliest years about things that are close to him around the home and the school. Gradually, with increasing age, his horizon widens to include the community, the state, the country, and finally the whole world. Throughout his early impressionable years a child's study of science should give him an understanding of how to make life richer, safer, happier and more productive, both for himself and for society.

To the young child, the world is all in one piece. His science should be broad and encompassing, not broken into tiny fragments or specialized disciplines, such as chemistry, physics or biology. If the child is to grasp the true meaning of science and continue to use its methods throughout life, he must be involved personally in seeing and solving the problems of his own life. This can only result from a direct acquaintance with science from the earliest school years.

How the Syllabus has been Developed

The first effort to make a syllabus for classes I to VIII was made by the Directorate of Extension Programmes for Secondary Education at the request of the Punjab Government. Workshops were held New Delhi where science teachers from various states got together, examined existing syllabi and

developed a syllabus selecting major topics and concepts to be included in the general science course for classes I to VIII. The advice of several specialists was obtained on this syllabus. We specially thank Dr. A.C. Joshi, Vice-Chancellor, Punjab University for going through the syllabus and giving us his valuable suggestions. A series of general science texts based on this syllabus were written by a number of authors. This series included teacher's guides and work books for classes I and II, and textbooks for classes III to VIII. These texts have been translated into both Hindi and Punjabi and are currently in use throughout the Punjab State.

It was now felt necessary to re-examine this syllabus with a view to developing an all-India general science syllabus for classes I to VIII. Two workshops were arranged for this purpose, one in Delhi in September 1962 ; and the other in Bangalore in November 1962. The latter was directed by Shri S. Natarajan. Representatives were invited from various states. At this workshop the first draft of an all-India general science syllabus was prepared. It was decided that any topic introduced should be studied in sufficient depth so that the concepts and sub-concepts would be understood by the pupils and not merely memorized by them. The broad areas of content included in the syllabus were :

1. Air, Water and Weather. Classes I to VIII
2. Rocks, Soils and Minerals. Classes II to VII
3. Human Body, Health and Hygiene. Classes I to VIII
4. Safety and First Aid. Classes I to VIII
5. Housing and Clothing. Classes I to VII
6. Energy and Work. Classes IV to VIII
7. Matter and Materials. Classes V to VIII
8. Living Things. Classes III, IV and VIII
9. Plant Life. Classes I to VIII
10. Animal Life. Classes I to VIII
11. Scientists at Work. Classes I to VIII
12. Measurements. Classes III and IV
13. Our Universe. Classes I to VIII

All the major and sub-concepts for each of the areas were written as declarative statements so that these would serve as directives as to what to teach, specially for those teachers relatively uninformed in science. A beginning was made in writing activities to be used in developing each sub-concept. The main outlines for the syllabus were written in Bangalore and, much of the editing was done later at New Delhi by officers of the National Institute of Education. The concepts and sub-concepts have been checked for accuracy and for appropriateness. The biological science sections were checked by Dr. P. Maheshwari, Professor of Botany, Delhi University, and Dr. H.S. Vishnoi, Lecturer in Zoology, Delhi University, the physical science sections were checked by Dr. R.P. Mitra, Professor of Chemistry, Delhi University, and by Dr. R.N. Rai, Head of the Department of Science Education, National Institute of Education ; the human body, health and hygiene section was checked by Dr. S.C. Chakravarti of the Patel Chest Institute.

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The publication will include only statements of major concepts and sub-concepts. It is proposed to shortly follow this by suggested activities and experiments which will help the teacher in developing each of the sub-concepts. This publication is being brought out as an experimental edition. We invite our readers to send us their opinions and suggestions for the further refinement of the syllabus.

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UNIT I

AIR, WATER AND WEATHER

CLASS I

Major Concepts	Sub-concepts
1. Air is every where.	a. We can feel the air move. b. Air occupies space. c Air offers resistance.
2. Air is necessary for	a. breathing b. kindling fire.
3. Water is needed for life, for	a. drinking b. washing. c. cooking. d. growing plants. e. rearing animals

3. Human Body, Health and Hygiene
I—VIII

1.
2. to time
3. y be
4.
5.

a. dry or moist.
b. hot or cold
c. sunny or cloudy.
d. calm or windy

ater vapour.

a. Wet clothes dry by evaporation.
b. White-wash dries by evaporation.
c. Water goes into the air on evaporation.
d. Water vapour condenses on the sides of a glass containing ice-cold water
e The amount of water vapour varies in different seasons.

Air has dust and smoke.

a. There are dust particles in air.
b. Smoke rises into the air from chimneys and fires.

Dust and smoke should not be breathed.

a. Dust or smoke even in small quantities may harm the lungs.

Major Concepts	Sub-concepts
	b Dust may carry disease germs. c. Too much dust or smoke suffocates.
4. Fresh air is needed for health.	a. Air breathed out brings impurities with it. b. When things burn, impurities go into the air. c. We have doors and windows to get fresh air. d. We play out-doors to get more fresh air
5. Air in motion is wind	a. Wind has direction. b. Wind has speed. c. Wind exerts force.
6. Water is obtained from various sources	a. We can get water from rain, river, tank and springs. b. We can dig and drill wells to get water.
7 Not all water is safe to drink.	a Water may contain harmful organisms. b. Water may contain dissolved salts. c. Even clear water may not be fit for drinking.
8. Water is constantly undergoing changes.	a. Evaporation takes place at all times. b. Clouds are formed from evaporated water. c. Rain comes from clouds. d. Rain water flows or sinks underground. e. Surface water flows to rivers and the sea. f. Underground water comes to us as spring or well water.

CLASS III

1. Water exists in three states which are interconvertible.	a. Ice melts into water. b. Water freezes into ice. c. Water evaporates into vapour. d. Water vapour condenses into water.

Major Concepts	Sub-concepts
2. There are many types of weather	a. The sun, wind, clouds and rain determine the weather. b It is warmer when the sun is shining than at night. c. It is warmer in the sun than in the shade. d. It is warmer when the sun's rays are overhead than when they are slanting. e Days may be windy or rainy or cloudy or one or more of these. f. Cloudy nights are warmer than clear nights.
3. The weather changes	a It may change during the day or night, from day to day, and from time to time. b. It may change due to a storm. c. It may change with the direction of wind.
4. A thermometer is used to measure warmth.	a. Heat causes liquids to expand and rise in a thermometer. b. Cold causes liquids to contract in a thermometer c. Temperature is expressed in degrees.
5. Weather influences travel, work, play and clothing.	a. Travel is not pleasant in rainy weather. b. Travel is risky in stormy weather c. Outdoor work is hard in bad weather. d Open air games are uncomfortable in bad weather. e. Foggy weather reduces visibility and makes travel risky. f. Fine weather is good for sport or picnics
CLASS IV	
1. The sun plays an important part in causing changes in weather.	a. The sun warms the earth during day. b. The sun warms the earth more in summer than in winter.

Major Concepts	Sub-concepts
	i) There are more hours of sunshine in summer than in winter. ii) The sun is more directly overhead in summer than in winter. So the sun's rays are more intense and warm the earth more. c. During the day, the land gets warm sooner than the water and the air above the land gets warm sooner than the air above the water. d. At night land cools faster than water. The air above land cools faster than that above water.
2. Hot air is lighter than cold air.	a. When air is heated, it expands and becomes lighter. b Cold air pushes up the warm air. c. Replacement of warm air with less warm air causes wind. (Loo winds get heated as they move over the hot desert. d. The more the difference in temperature between the cold air and the warm air, the stronger will be the wind.
3. Change of water into vapour is called evaporation.	a. When water evaporates, it gets into the air. b Water evaporates faster when i) it is windy. ii) the temperature is high. iii) the exposed surface is large. iv) the air is dry.
4. Warm air holds more water vapour than cold air.	a. Sufficient lowering of temperature changes water vapour into droplets of water or into crystals of ice. b. When water vapour in the air is converted into drops of water, it is called condensation. i) Dew is formed when water vapour condenses on cold objects.

Major Concepts	Sub-concepts
	ii) When objects are freezing cold, frost is formed from water vapour. iii) When water vapour condenses on particles in the air, it forms mist and clouds in the sky or fog on the ground. iv) When water vapour freezes on some particles in the air, it forms crystals of snow.
5. Precipitation of water occurs in different ways.	a. Rain is formed when drops of water in the cloud grow too large to stay up in the air. b. Sleet is formed when rain drops fall through cold air and get frozen. c. Hail forms when sleet is blown up into the clouds again and again. d. When the air is sufficiently cold: minute snow crystals collect together and fall and this is called snow.
6. Water becomes impure in many ways	a. Many materials are carried by water. b. Many materials dissolve in water. c. Sedimentation, decantation and filtration will remove suspended impurities. d Rain water is usually clean.
7. Water is present underground	a. Water passes through porous material. b. Water is stopped by non-porous rocks. c. The level of water (water table) below the ground level may be low or high. d. Swamps are formed when the water table is close to the surface of the ground. e. Water may be obtained from below the water table in lakes, springs or wells.
CLASS V	
1. Air is used to inflate things.	a. Air can be blown into a balloon or air mattress.

Major Concepts	Sub-concepts
	b Air can be pumped into the bladder of a football or tyre.
2. Air is used to move liquids.	a. Air is removed from a straw while it is used for drinking, so that the liquid may rise. b. Air from an ink filler or syringe is removed before using it so that liquid may be lifted.
3. Air contains many gases useful to man.	a. The gases oxygen, nitrogen, carbon-dioxide, and water vapour are present in air. b. Oxygen is used when fuels burn. c. All living things use oxygen in respiration. d Plants and animals use oxygen and release carbondioxide in respiration. e. Plants use carbon dioxide and release oxygen when making sugar.
4. Water is a good solvent.	a. Water dissolves many things. b Dissolved substances can be separated from water by various ways. (i) evaporation (ii) distillation
5. Water may contain insoluble substances and germs	a. Insoluble materials and also some disease germs can be removed by sedimentation and by filtration. b. Disease causing germs must be kept out of water or be removed or be killed to make water safe for drinking. (i) They may be kept out of water by sanitary measures. (ii) Some, but not all germs may be kept out of water by sedimentation and filtration. (iii) They may be killed by prolonged boiling or by adding certain chemicals.

Major Concepts	Sub-concepts
6. Water exerts pressure	a. Water flows from high level to low level. b. Water exerts pressure equally in all directions. c. Water pressure varies with depth.

CLASS VI

1. Oxygen and moisture present in air are necessary for rusting.	a. Oxygen from air combines with the metal to form an oxide of rust. b. Water makes rusting occur faster. c. Rusting can be prevented inmany ways. (i) By keeping metals dry. (ii) By a protective coating of oils or paints. (iii) By a protective covering with a film of another metal like zinc or tin. (iv) By alloying with other metals.
2 Burning, rusting and respiration are similar processes	a. All use oxygen from air. b. All produce oxides. c. All produce heat.
3 Some waters are hard and some are soft.	a. Hard water does not produce lather easily and hence wastes soap. b Hardness is due to certain dissolved salts in water. c. Hard water can be softened by several physical and chemical methods.

CLASS VII

1. Air surrounds the earth like a giant blanket. It is in layers. These layers extend upwards for hundreds of miles.	a. Air is all around us. b. The atmosphere is in layers and these layers have definite characteristics.
2. The air is composed mostly of gases, which are compressible, have weight and exert pressure.	a. Air is compressible. b. Air has weight. c. Air exerts pressure; the pressure is due to the weight of the air.

Major Concepts	Sub-concepts
	d Air becomes progressively less dense with an increase in altitude
3. Air pressure is measured by a barometer.	a Air pressure may be measured by various home-made barometers. d. Air pressure may be measured more accurately by a mercury barometer. e Air pressure may be measured by aneroid barometer.
4. The atmosphere may be considered a giant heat engine that distributes the energy which falls unequally upon the earth's surface by means of winds.	a. Hot air weighs less than cold air. b. Heat energy makes winds blow—winds carry heat by convection currents
5. Air pressure is used in many ways in daily life.	a, Air pressure is used as a cushion. b. Air pressure is used to lift water. c Air pressure is used in judging altitude d. Air pumps are used to move things.

CLASS VIII

1. Temperature, pressure and humidity are important factors in weather.	a Human beings can work efficiently and comfortably when the temperature of the surroundings is 24° C b. Temperature is measured by thermometers, pressure by barometers, and humidity by hygrometers. c. Pressure and temperature decrease with altitudes. d. Other instruments are also used in recording and predicting the weather ; a radiation gauge measures hours of sunshine ; a rain gauge, cms. of rainfall ; an anemometer, the velocity of the wind.
2. Winds are caused by the difference of air pressure at different places.	a. The temperature of the air in the troposphere layer is the chief factor in determining the pressure of the air.

Major Concepts	Sub-concepts
	b. Winds blow from centres of high pressure towards centres of low pressure. c. Winds are named after the direction from which they blow.
3. Winds blow over the whole surface of the earth in a characteristic pattern.	a. Winds distribute the energy which falls from the sun unequally upon the earth warming the polar regions and cooling the equatorial regions b. The winds of the earth blow in belts-belts determined by the unequal heating of the earth's surface and by the rotation of the earth c The winds circulate vertically in a cellular pattern.
4. Energy absorbed when water evaporates is distributed by winds and released when water vapour condenses and precipitates.	a Clouds are of different kinds. b Storms are of different kinds. c The violence of certain storm indicates the vast amount of energy released. It is the latent energy of the water vapour that is released in storms. d. Lightning conductors are used to protect building from lightning.
5. Data obtained regarding the temperature of air, its pressure and its humidity can be used for forecasting weather.	a. High temperature forecasts the formation of low pressure. b. Low pressure forecasts strong winds or storm. c. High pressure forecasts fine weather. d. Greater humidity forecasts low pressure.

UNIT II

ROCKS, SOILS AND MINERALS

CLASS II

Major Concepts	Sub-concepts
1. There are many kinds of rocks.	a. Rocks occur in many sizes and shapes. b. Rocks occur in many colours. c Some rocks are soft, some are hard; some are sharp, some are smooth; some split in layers, some are massive; some are grains cemented together; some are crystals

CLASS III

1. There are different kinds of soils	a. Soils vary in size of particles. b. Soils vary in amount of organic matter. c. Clay, loam, sand are different forms of soil.
2. Different kinds of soils are formed by disintegration and by movement.	a. Rocks are broken into soil by expansion and contraction due to changes in temperature, and by freezing. b. Rocks are broken into soil by rubbing together Agents are wind, running water and moving ice.

CLASS IV

1. Soil is found in layers.	a. The top layer forms top soil. b. The lower layer forms sub-soil.
2. Soil is washed away by rain and rivers.	a. Soil washed away by rain water or a river is deposited at other places. b. River deposited soil is rich.

Major Concepts	Sub-concepts
3. Winds also cause erosion.	a. Winds erode the soil. b. Winds deposit the soil at other places. c. Top soil is easily affected by wind erosion.
4. Soil is conserved in many ways. In every case, man attempts to slow down the movement of the eroding agent.	a The planting of trees and the growing of grass conserve soil. b. Bunds or levees conserve soil. c. Terracing slopes conserve soil.

CLASS V

1. Rocks are of three types. Sedimentary, Igneous and Metamorphic.	a. Sedimentary rocks are layered in structure b. Igneous rocks are columner in structure c. Metamorphic rocks are foliose, banded or massive in structure
2 Rocks contain minerals	a. A mineral is an inorganic substance, found in nature, which has a definite chemical composition b Most of the minerals found in the rocks have a crystalline form. c. Some common rock minerals are quartz, feldspar, mica and calcite. d. Metal ores occur as rock minerals.
3. Rocks and minerals are useful to man in many ways.	a. Rocks are used in the construction of buildings, dams, roads and in other ways. b. Some rocks and minerals are used in agriculture. c Metals are obtained from their ores. d. Deposits of metal ores in the rock are spotted to obtain metals for the industry.
4. Coal and petroleum are commercially called minerals.	a. Coal and petroleum are found with the rocks, b. Coal and petroleum, unlike other minerals are obtained from the remains of organisms in the rocks.

Major Concepts	Sub-concepts
	c Coal has been formed from vegetable matter by very slow geologic processes. d Petroleum has been formed from dead sea animals and plants by very slow geologic processes.
CLASS VI	
1. Different types of rocks are formed under different conditions	a. The sedimentary rocks have been formed at the surface of the earth, either by the accumulation and cementation of fragments of rocks, minerals, and organisms, or as precipitates from sea water. b. Formation of sedimentary rocks is a very slow process c. Igneous rocks have formed from liquid lava that solidified on cooling. d Igneous rocks have formed both on the surface and below the surface of the earth. e. Metamorphic rocks have been formed out of pre-existing rocks below earth's surface under great changes due to heat pressure and chemical changes.
2. Changes in the form and location of rock materials are brought about by processes of weathering, erosion and deposition.	a. Weathering is the crumbling of rock material without it being moved. (i) Rocks weather chemically. The chief chemical agents are oxygen, water, carbon dioxide and acids from plants. (ii) Rocks weather mechanically. The chief mechanical agents are quick changes in temperature freezing, and the growth of plant roots. b. Erosion is a grinding or gnawing process. Rock material always moves When erosion takes place deposition also takes place somewhere else. The chief agents of erosion are : (i) Running water. (ii) Wind.

Major Concepts	Sub-concepts
	(iii) Moving ice (glacier). (iv) Gravity (rock falls from a cliff).
	c. The nature of deposited materials depends upon the erosive agents. (i) Running water deposits large rocks when flowing very swiftly, pebbles when moving swiftly, sand when moving slowly, and fine clay particles when nearly still. (ii) Wind carries fine particles only; fine sand and silt. (iii) Ice carries fine silt, sand, rocks—deposits are a conglomerate. (iv) Gravity deposits at the foot of a cliff include rock material of all sizes.
3. The mineral constituents of a rock may be igneous at one time, sedimentary at another, and metamorphic at another time.	a. As a rock, for example, granite is eroded, the hard minerals (quartz) pulverize the softer minerals, (feldspar and mica). The hard minerals also erode the other hard particles. The result is that the minerals are sorted according to size of particles, because of differing hardness. (i) Quartz is deposited as sand. (ii) Mica and feldspar are deposited as clay. (iii) The sand sediments later become cemented together to form sandstone (sedimentary rock). The clay sediments become cemented together to form shale (sedimentary rock). (iv) Under conditions of heat and pressure, the sand may be cemented together with quartz to form quartzite (metamorphic rock); the shale may be changed to form slate or mica schist (metamorphic rocks).

Major Concepts	Sub-concepts
	(v) Under conditions of heat and pressure, alternate layers of sandstone and shale may be changed to form gneiss (metamorphic rock).
	b. Limestone, a sedimentary rock composed largely of the mineral calcite, may be changed by heat and pressure to form marble (metamorphic rock). Either limestone or marble could be dissolved in lava to become a part of igneous rock.
4. Rocks show the characteristic of the minerals of which they are chiefly composed.	a. Limestone and marble are relatively soft rocks and may be easily cut. Calcite, the mineral of which limestone and marble is chiefly composed, is relatively soft.
	b. Limestone and marble rocks are easily dissolved in weak carbonic acid from decaying organic wastes. This is a characteristic of the mineral calcite of which it is chiefly composed.
	c. Shale, slate and mica schist rocks are softer than sandstones, for the minerals of which they are composed are softer.
	d. Slate and mica schist tend to split in thin layers as does the mica mineral of which these rocks are largley composed.
CLASS VII	
1. Good soil must have enough of the minerals required for growth of the plants.	a. Minerals in the soil are consumed when plants grow
	b. Deficiency of minerals in the soil can be made up by adding manures or fertilizers.
	c. Rotation of crops conserves minerals in the soil.
2. Soils in regions of heavy rainfall are usually deficient in mineral salts.	a. Mineral salts which plants can use are soluble in water.

Major Concepts	Sub-concepts
	b. Where rainfall is heavy, these mineral salts may be dissolved in the water, carried down through the soil, and away toward the ocean in underground movement of water.
	c The extent of leaching may be lessened by keeping a cover crop of grass or other vegetation to hold the soil and absorb the minerals.
3. Soils in arid regions may contain too much and too many mineral salts.	a. With limited rainfall, the water that falls soaks into the ground, dissolves the mineral salts for some depth, and then rises to the surface by capillary action. As the water evaporates, the dissolved salts remain. Too much and too many mineral salts prevent the growth of plants.
	b. By flooding the land with water and draining off the water, excess minerals, salts may be removed.
4 Irrigated soils may become 'salted'.	a When soils are irrigated from shallow wells, the water moves down through the soil, dissolves minerals, is then pumped to the surface, and used over and over again. Evaporation is probably high, and salt content of top soils increases.
	b. Improved methods of irrigation lessen the tendency of soils to become salty.
	(i) Water from deep wells is preferable to water from shallow wells.
	(ii) Water from large storage reservoirs is preferable to water from shallow wells.
	(iii) Contour terracing, or the construction of simple bunds along contours make possible equal dosage of water from irrigation ditches. By using controlled

Major Concepts		Sub-concepts
		amount of water, salting is lessened (iv) In badly salted land, drainage ditches can be used to flush out the excess salts from the soils (v) Salty water may also be pumped out by tube wells and carried to rivers through lined channels.
5. Rocks and minerals are the sources of metals and non-metals required in large quantities by industry. Minerals comprise much of the wealth of a nation.	a	Some of the common rocks used commercially are : (i) Clay which is used in brick, tile and cement. (ii) Limestone which is used in cement, as a building stone for road ballast and for agricultural purposes. (iii) Sand and gravel which are used in concrete for building and for roads. (iv) Dolomite which is used for fire brick, in refining iron from ore, and for agricultural purposes. (v) Basaltic rocks which are used for buildings and roads.
	b.	Some of the common minerals found are : (i) Haematite which yields iron. (ii) Bauxite which yields aluminium. (iii) Galena which yields lead and silver (iv) Tinstone (casserite) which yields tin. (v) Chalcopyrite which yields copper (vi) Caliche which yields iodine. (vii) Gypsum which yields sulphuric acid which is used in the making of fertilizer and other things. (viii) Rock salt which yields salts, chlorine and caustic soda. (ix) Saltpeter which yields nitrates.

Major Concepts	Sub-concepts
	(x) Monazite sand which yields radioactive metals. (xi) Quartz from sand which is used for glass industries.
6. Stores of minerals vary in abundance.	a. Stores of such common rocks as clay, limestone, sand and gravel are present in adequate amounts. b. Stores of most metals, fuels and some others are present in limited supply c This supply should be conserved Coal and petroleum are chiefly obtained by mining from beneath the surface of the earth.
7. Sea water is becoming of increasing importance as a source of minerals.	a. Materials now obtained from sea water are : salt, magnesium, bromine, and iodine b. The depths of ocean are strewn with nodules that are rich in manganese, copper, cobalt, nickel and phosphorus. These will probably be mined in the future.

UNIT III

HUMAN BODY, HEALTH AND HYGIENE

CLASS I

Major Concepts	Sub-concepts
1. Habits of keeping clean are necessary for health. Cleanliness consists in :	a. cleaning of hands, face, eyes, mouth, nose, teeth ; taking bath ; trimming nails ; combing hair and wearing clean clothes. b. keeping the classroom and home clean. c. having one's own drinking vessel, if possible. d covering the mouth while coughing or sneezing e. avoiding spitting in public places.
2. Habits of rest and sleep are necessary for health.	a. Rest rebuilds the body b. Regular bed time habits are necessary for sufficient rest. c. About nine hours of sleep is necessary.
3. Habits of exercise and recreation are necessary for health.	a. Exercise makes the body strong b. Recreation makes the mind feel fresh. c. Play ensures good sleep d. Play leads to good appetite.
4. Human beings have various needs. They need :	a. air to breathe—free from dust. b. water to drink—free from contamination c. food to eat—free from contamination. d. clothes to cover and protect the body. e. shelter to protect from sun, rain, natural forces and enemies
5. Physical growth is shown by an increase in height, girth and weight.	a. Children grow in weight, in height, and in girth. b. Some parts of the body grow faster than others, e g. legs of a child.

Major Concepts	Sub-concepts
6. Good food is essential for good health.	a. Milk, meat, eggs, fish, cereals, pulses, vegetables, fruits, ghee and oil are some of the articles of food.

CLASS II

1. Exercise leads to the development of a healthy and strong body,	a. The body has big and small muscles. b. Bones and muscles move the body c. Bones and muscles work together. d. Muscles must be used to grow strong. e Exercise builds muscles f. Bone and muscles give shape to the body.
2. Good postures are necessary for maintaining proper shape and health of the body	a. Correct posture is necessary for keeping the body parts in their proper natural relationship. b. Parts function better when in proper relation with each other.
3. Children should eat good food for health.	a. Foods are of different kinds. b. Some foods make our bones and muscles, for example, milk, meat, eggs, fish, gram, dal c. Some foods give energy for work and play, for example : sugar, butter, potato, oil, cereals. d. Fruits and vegetables are required for health.
4. Children should have proper food.	a. Children should eat at regular intervals. b. Undereating and overeating should be avoided. c. Spoilt food causes disease. d. Food exposed to flies and dust is dangerous to eat. e. Clean food should be eaten in clean places in clean plates. f Water to drink should be boiled.

Major Concepts	Sub-concepts
	g. Food must be well chewed. h. Hands and face should be well washed before taking food and after taking food.

CLASS III

1. The nose, the wind pipe and the lungs are the parts of the breathing system.	a. The chest expands when we take in breath, and contracts when we breathe out. b. We take in fresh air ; the air we breathe out contains wastes. c. We breathe faster when we work and run, than when we sit idle.
2. Healthy breathing habits are essential.	a. The nose cleans and warms the air we breathe b. We should breathe through the nose. c. Tight fitting dresses around the waist and chest, that interfere with free movements of the chest should be avoided. d. We should not breathe the same air over and over again, as it becomes more and more impure
3. Human body works like a machine.	a. It is with our sense organs that we see, hear, smell, taste and feel. b. Different organs in our body perform different functions, such as breathing, digesting food, circulating blood and removing wastes.
4. Many organs are involved in a particular function.	a. The food that we eat passes through the mouth, gullet, stomach, small intestines, large intestines, and the undigested part passes out. b. The blood is pumped by the heart and distributed to all the parts of the body by means of blood vessels.

Major Concepts	Sub-concepts
	c. The heart pumps the blood into the lungs where the blood is purified by the fresh air we breathe. d. The lungs, the kidneys and the skin remove wastes from the body.

CLASS IV

Food

1. The body changes the food eaten into a soluble form which is absorbed and used for energy and growth.	a. Food is broken into small pieces by the teeth. b. Digestive juices moisten and dissolve part of the food c. Digestion is the changing of food into a soluble form
2. Fruits, nuts and some vegetables are eaten raw (uncooked).	a. Fruits and vegetables should be washed and sterilized before eating. b. Exposed, cut fruits in a market become contaminated by germs from dust and flies.
3. Cooking improves foods in several ways. It makes	a. some foods more tasty and pleasing. b some foods more digestible. c. food safer to eat by destroying harmful germs.
4. There are different ways of cooking.	a. Boiling, roasting, frying, steaming, and baking are different ways of cooking. b. Different foods are cooked in different ways.
5. Care should be taken not to waste foods in cooking.	a. Cooking destroys certain vitamins. Overcooking should be avoided. b Certain minerals and vitamins are dissolved in cooking water. No more water than will be taken with the food should be used in the cooking.

Major Concepts	Sub-concepts
6 Foods need to be protected and preserved.	a Various agencies spoil food grains, vegetables, fruits b Storing at low temperatures preserves foods. c. Storing in air-tight containers preserves foods. d. Salting preserves foods. e. Boiling preserves foods f. Keeping in sugar syrup preserves foods. g. Cooked food should be protected against bacteria, yeast and mould. h. Cooked food can be stored at low temperature.

Teeth

1. Good teeth are useful to man in many ways.	a. Good teeth are necessary to chew our food thoroughly so it may be digested easily. b. Teeth add to the beauty and expression of the face. c Teeth are used in speaking clearly.
2. There are three different types of teeth.	a. The incisors are used in biting or cutting. b. The canines are used in tearing food. c. The molars are used in grinding or masticating food.
3. A baby loses its first teeth (milk teeth) as it grows permanent teeth.	a Incisors are replaced at seven or eight years of age b The first permanent molars come at six years of age ; the last set from seventeen to twenty-five years of age.
4. Teeth begin to decay if we do not keep them clean.	a. Food particles if left sticking to the teeth, begin to putrify. b. The injurious substances formed by this putrefaction corrode the teeth and cause cavities. c. More food particles stick in the cavities and the teeth further decay.

Major Concepts	Sub-concepts
	d. Teeth must be cleaned both before and after taking food. e. Exercise of the teeth, and gums aids in keeping them healthy.
5. Decaying teeth cause disease and pain.	a. Bad teeth give rise to in digestion and stomach troubles. b Bad teeth cause foul smell c. Decay of teeth leads to tooth-ache.
Microbes	
1. These are living things all around us which are too tiny to be seen with the naked eye These are microbes, protozoans, bacteria, yeast and viruses.	a. Microbes are found every where in air, water and soil. b Microbes are too small to be seen by the naked eye. The microbes usually found are bacteria, protozoans, moulds, yeast and virus
2. Food, moisture and a suitable temperature are necessary for the microbes to grow and to multiply.	a. Most microbes grow best in liquid or semi liquid foods. b Most microbes grow best at warm temperatures—from room temperature to body temperature
3. Some microbes are useful to man and some are harmful.	a. Some bacteria are useful in making curd, in making the soil fertile, and in decaying waste organic matter. b. Bacteria make food unwholesome. Fish, meat and vegetables become rotten. c. Some microbes cause disease like cholera, typhoid.
4. The body protects itself from disease germs in various ways	a. Our body protects itself better when it is healthy and strong. b. To develop resistance against diseases we must have good food, exercise, rest, pure air, pure water, sunlight, healthy surroundings and healthy habits.

Major Concepts	Sub-concepts
1. The nervous system consists of three systems.	a The central nervous system consists of the brain and the spinal cord. b The peripheral nervous system consists of the ganglia and the nerves, that take messages from the sense organs to the central nervous system and those that take messages from the central nervous system to the muscles and glands. c The autonomic nervous system consists of the ganglia and nerves that regulate the internal organs operating involuntarily.
2. Nerves perform different functions.	a. Nerves carry messages from different sense organs to brain b. It is by nerves that we see, hear, smell, taste and feel. c. Nerves carry messages from the brain to the muscles and glands. d. The nervous system is used by us to adjust to an environment.
3. Sense organs should be well cared for.	a. The eyes are delicate sense organs. 1. Reading in dim or glaring light causes eye strain. 2. Reading of fine print puts a strain on the eyes. 3. Looking directly at the sun or very bright light hurts the eyes. 4. When reading, the light should come from the proper direction, in most cases over the left shoulder. The eyes should be well cared for. 1. The eyes should be protected from blows and sharp instruments. 2 Dust and dirt should be kept out of the eyes. Foreign bodies in the eyes should be washed out with water. The eyes should not be rubbed.

Major Concepts	Sub-Concepts
	3. Flies carry infection from sore eyes to healthy eyes. c. The ears should be protected from hard blows. Pointed objects should not be used to clean the ears.
4. There are different bones and muscles in the body. They have specific functions to perform.	a. The skull, the backbone, the breast bone, the ribs and the bones of the limbs are the main bones. b. The bones give shape to the body and protect the delicate parts c. There are voluntary and involuntary muscles in the body. d. The muscles of the limbs are voluntary and those of the heart and intestines are involuntary.
5. Different types of joints perform different functions.	a. Some bones are movable and some are immovable. b. Bones move at the joints. There are four kinds of joints.
6. Shape and movement of body are accomplished by bones, muscles, joints, ligaments and tendons.	a. All movements of the body are the result of muscular contraction. b. Muscles lend a graceful appearance to the body. c. Physical exercise and right posture are essential for normal development of muscles.
7. Diseases are caused by micro-organisms.	a. These organisms are of different shapes and are too small to be seen by the naked eye. b. Some are plants and some are animals. c. Some of them can be seen with a powerful microscope.
8. Communicable diseases can be carried from one person to another.	a. Ringworm, scabies, chicken pox, small pox, and scarlet fever are spread by contact. b. Cold, influenza, pneumonia, tuberculosis, mumps, measles, scarlet fever,

Major Concepts	Sub-concepts
	chicken pox, small pox and diphtheria are spread, through air or carried by the unwashed hand from one person to another. c. Cholera typhoid and dysentery are spread by water and food. The germs from the excreta of an infected person may contaminate water or food directly or be carried by hand or flies, cock-roaches or vermin. d. Malaria, filariasis, yellow fever and certain virus diseases are carried by mosquitoes. e. Bubonic plague is carried by fleas which live on rats. f. Typhus fever is carried by lice which live on infected persons.
9. Precautions help in preventing the spread of communicable diseases.	a. Food and drinking water should be kept free of contamination. b. Doubtful water should be disinfected before drinking c. Food should be protected from dust and flies. d. Home and surrounding should be kept clean. e. Hands should be washed before eating and after toilet and after blowing one's nose or after any contact with a patient. f When ill, one should avoid close physical contact with others. g. Contact with the patient should be avoided. h The patient should be isolated in case of certain diseases. i. All infected articles should be disinfected or destroyed. j Other measures like inoculation, and vaccination should be taken.

CLASS VI

Major Concepts	Sub-concepts
1 Man needs food to grow and to work.	a. Food gives energy to move and do work. b. Food is essential for growth. c When we work some parts of our body are worn out. The worn out parts are replaced by food.
2. Different types of food cater to different needs of the body.	a. Some foods provide energy and may be called fuel foods. 1. Sugar, cereals, potato, pulses and many vegetables contain carbohydrates which supply heat and energy to the body 2. Ghee, butter, oils, dry nuts, etc., contain fats which also supply energy. b. Some foods build the body and repair the worn out parts. These are called proteins Meat, eggs, milk, pulses, peas, beans and fish are protein foods. These also furnish energy. c. Certain foods contain minerals and salts which are required in small amounts for proper growth and body building : 1 Calcium is needed for building bone and teeth. 2 Iron is needed for red blood cells. 3. Phosphorus is needed for bones, nerves and body growth. 4. Iodine is needed for balanced growth. Milk, fish, meat, fruits, green vegetables, eggs, and whole cereals supply minerals and salts with food. d. Some foods contain small amounts of substances called vitamins which are needed for body growth, resistance from diseases and prevention of certain diseases. Vitamins are obtained from milk, eggs, whole cereals, green

Major Concepts	Sub-concepts
	vegetables, fish liver, fresh fruits and from artificial sources. 1. Vitamin A is required for building the body, healthy skin and good eyesight. Its deficiency leads to night blindness and lowers the resistance to infection It is obtained from leafy, green and yellow vegetables, whole milk, butter, eggs, liver, kidney 2. Vitamin B is required for the health of the skin, proper functioning of nervous system and for helping growth. Its deficiency leads to beri-beri, anaemia and pellagra. It is obtained from milk, meat, liver, whole grain cereals, whole grain bread, yeast, eggs, green peas and peanuts. 3. Vitamin C is required for good bones, teeth and gums. Its deficiency leads to scurvy, bleeding gums and tendency to bruise. It is obtained from citrus fruits (lemons, oranges), guavas, mangoes, apples, tomatoes and green vegetables. This vitamin is readily destroyed by cooking. 4. Vitamin D is required for building good bones and teeth Its deficiency causes rickets. Exposure to sunlight enables the body to build this vitamin. It is obtained from fish liver oils, milk, eggs and some fish.
3. Quantity of energy-giving and body-building foods must be sufficient for the needs of the body.	a. Growing children require more body-building materials b. Manual workers require more carbohydrates and fats

Major Concepts	Sub-concepts
	c. Sportsmen and athletes need foods which supply energy quickly d. Vitamins of the right type are needed for normal growth and for the prevention of deficiency diseases.
4. Food has to be digested before it can be absorbed and assimilated.	a. Most food is really in an insoluble form. b. When the food is converted into a soluble form it can pass through the walls of the digestive organs into the blood system This conversion into soluble form is digestion.
5. Food is digested and absorbed in the different parts of the digestive system	a. The mouth, foodpipe, stomach, duodenum, small intestine and large intestine form the alimentary canal. b. Certain glands are associated with the digestive system which secrete juices to digest various types of food. These are liver, pancreas, salivary and intestinal glands c. Digestion of food mainly takes place in the mouth, stomach and small intestine. d Absorption of food mainly takes place in the intestines. e. The undigested and unabsorbed food collects in the large intestine and is periodically expelled.
6. Right habits of eating and getting rid of waste materials are necessary for good health.	a. Meal habits should be regular. b. Daily diet should be balanced. c. Movement of bowels must be regular. If not, the diet needs to be altered by adding some leafy vegetables and fruits to the diet.

CLASS VII

I. Respiration and Circulation

1. The release of energy from food is a fundamental activity of all living things. This is called respiration.	a. When food within the cells is oxidized, energy is released and carbon dioxide produced.

Major Concepts	Sub-concepts
	b. In this process of respiration every living cell needs a constant supply of oxygen and food.
2. Oxygen is taken to the tissues in many parts of the body, and likewise carbon dioxide and water are carried from the tissues in many parts of the body This involves the respiratory system and the circulatory system.	a The respiratory system brings in air to the circulatory system and takes it from it to expel outside. It is really a ventilating system b. The circulatory system transports food and oxygen to and waste materials, carbon dioxide and water from the tissues.
3. The respiratory system consists of nostrils, pharynx, trachea, bronchii and lungs.	a. The air is moved in and out of the lungs by the action of the muscles between the ribs and the diaphragm b. Air enters the body through the nostrils and gets warmed and filtered. c. The warm air passes through the windpipe and is distributed to the two lungs through the bronchii and bronchial tubes. d. The lungs consist of millions of tiny air sacs in which the final branches of the bronchial tubes end. e. The walls of the bronchial sacs are covered with a network of capillaries through whose thin walls, oxygen diffuses from air sacs to blood capillaries and carbon dioxide and water vapour pass out from capillaries to air sacs of lungs. f. The haemoglobin in red blood cells has the capacity to absorb large quantities of oxygen. This oxygen is carried to the tissues by the blood stream g. The oxygen from the haemoglobin diffuses through the capillary walls to the cells of the tissues. h. Carbon dioxide and water diffuse out from cells into the capillaries. When the blood reaches the lungs the waste

Major Concepts	Sub-concepts
	gases diffuse out from the capillaries of the air sacs into the lungs
4. The circulatory system consists of the heart, arteries, veins, capillaries and blood.	a The heart is an involuntary muscular organ. It ceaselessly pumps blood to all parts of the body. b. Arteries carry blood from the heart to the rest of the body. Their walls are muscular and they contract along with the heart. c. The arteries finally branch into fine capillaries which run through the tissues of various organs. d. These capillaries unite to form veins which carry blood back from the organs to the heart. Veins have valves which prevent back flow of blood. e. The pulmonary artery takes blood from the heart to the lungs to oxygenate it. f The pulmonary veins take the oxygenated blood from the lungs to the heart for circulation in the body. g The circulatory system is a closed system of pipes containing blood.
5. The blood has many functions.	a. Blood transports oxygen, food and carbon dioxide and other waste materials to and from appropriate organs and tissues of the body. b Blood regulates temperature c Blood fights microbes entering the blood stream. d. Blood prepares antitoxins to neutralise poisons formed in certain diseases. e. Blood forms clots in minor cuts and injuries preventing further loss of blood.
6. Breathing and circulation of blood are inter-related, involuntary and continuous processes.	a. Breathing cannot be stopped consciously for more than a few moments. b. The pulse beats constantly indicating the contraction and expansion of the heart.

Major Concepts	Sub-concepts
7. When a man loses lot of blood he needs a blood transfusion to save his life.	a. There are four types of blood b For blood transfusion a patient needs a compatible type of blood. c. Different types of blood are donated by different individuals. d Only healthy people after medical examination can donate blood, once in three months. e. A healthy man can donate half a litre of blood at a time. f. The donated blood stored in hospitals is called a blood bank.
II. **Excretion**	
1. All living cells produce waste materials which are excreted through various organs, namely, lungs, kidneys, and the skin.	a. Carbon dioxide and water are formed when food is oxidized in the body cells. b. Proteins break up into various compounds containing nitrogen. c. Accumulation of waste products is harmful to the body d. Blood circulation takes all waste products to respective excretory organs.
2. The lungs remove waste products of carbon dioxide and water vapour.	a. The blood from all over the body enters the lungs through the heart. b. Carbon dioxide and water vapour are expelled with air breathed out.
3. The kidneys remove nitrogenous waste and salts from the blood.	a. The kidneys contain thousands of tiny tubules which have a net work of blood capillaries. b. The nitrogenous waste, salts and water are removed from these capillaries and they form a mixture called urine. c. The tubes of the kidneys join into larger and larger tubes and finally into one large tube from each kidney to lead to the urinary bladder.

Major Concepts	Sub-concepts
	d. Urine collects in the urinary bladder and is periodically expelled when the bladder is nearly full.
4 The skin consists of two layers that perform different functions	a The upper layer is called epidermis which is a protective layer of horny cells b Beneath the epidermis is the inner layer called dermis which contains pigment cells, nerve endings, sweat glands, oil glands and hair roots. c. The sweat glands work like the kidney tubules and expel nitrogenous waste, salt and water as perspiration (sweat). d. The oil glands exude oil in tiny quantities to keep the skin smooth. e The pigment cells give the characteristic colour to the skin. f. The nerve endings give the sensation of touch, heat and cold, pressure and pain g The evaporation of sweat on the skin cools the body. h. A daily bath is essential to remove waste material deposited by evaporation of sweat

CLASS VIII

I Nervous System

1. The nervous system is made up of nerve cells.	a. A typical nerve cell has three parts : 1. The cell body 2. The dendrites 3. The axon b. Nerve cells are found principally in the brain, the spinal cord, and ganglia.
2. The nervous system coordinates the activities and functions of the body. It consists of three systems, the central nervous system, the peri-	a The central nervous system largely controls voluntary, conscious activities. It enables an organism to respond to stimuli from the environment.

Major Concepts	Sub-concepts
pheral nervous system and the autonomic nervous system. The brain and spinal cord house the neural centres of both.	b The autonomic nervous system largely controls the involuntary unconscious activities. c. Both systems are highly interdependent; they function in a unified way.
3. The central nervous system receives stimuli from the various sense organs and enables muscles and glands to respond.	a The sense organs (skin, nose, ear, eye and tongue) receive the stimuli from the environment b. Some nerves carry messages from the sense organs to the brain. c The message must reach the brain before we feel the touch, taste, smell, hear or see. d. Reactions to stimuli are transmitted from the central nerves system by nerves to the glands and muscles. e. The glands and muscles of the body respond to these stimuli.
4. Responses to external stimuli may be voluntary or involuntary, inherent or learned.	a. Some responses are voluntary or willed by the individual. b. A reflex action is an involuntary inherent response to a stimulus. c. Habits are learned responses that have become involuntary.
5. The sense of touch is located in the skin all over the body in a very large number of receptors.	a The skin has four kinds of receptors (nerve endings) each sensitive to one type of sensation · (1) Warmth (2) Cold (3) Pain (4) Pressure b. Nerve fibres carry stimuli from these receptors to the brain and the spinal cord.
6. The sense of taste is located in numerous taste buds on the surface of the tongue.	a. The taste buds in the different regions indicate the different tastes as sweet, bitter, salty, sour, etc.

Major Concepts	Sub-concepts
	b. Nerve fibres carry the stimuli to the central nervous system.
7. The sense of smell is located in the mucous lining of the nose as numerous olfactory buds	a. Each olfactory bud is a bunch of nerve cells with hair-like endings which are stimulated by the molecules of a particular substance breathed with the air. b. These stimuli are carried to the brain by nerves. c. The organs of taste and smell work together.
8 The ear is the organ of hearing. It has three parts ; external, middle and inner ears	a. All sounds come from vibrations of something moving back and forth. b. Without air around, no sound can be heard c The external ear is like a funnel which directs the sound waves down a slightly curved tube to the ear drum. d. Sound waves cause ear drum to vibrate. e. The middle ear consists of a chain of three small bones. One end of this chain is fixed to the ear drum and the other to the inner ear. This chain carries the vibrations to the ear drum. f. The inner ear consists of a tiny snail-shaped canal filled with a fluid called lymph and a swelling at one end provided with sensitive nerve cells. g. The vibrations reaching the inner ear stimulate these nerve cells which are carried by nerves to the brain. h. A tube connecting the middle ear with the throat maintains equal pressure on the drum on both sides of it
9 The inner ear is also an organ of balance.	a. The sensitive hairs in the curled canal of the inner ear are stimulated when the head is moved in any direction. b. An impulse through nerves to the brain makes one aware of the movement. c. Stimulation of these hair cells gives the sensation of position,

Major Concepts	Sub-concepts
10. The sense organ of sight is the eye.	a. An object is visible only if it sends light to our eyes. b. Each eye is shaped much like a ball It is set in sockets of bone in the skull. c. Additional protection is provided by eyelids and eye lashes d Ease of movement is provided by muscles attached to the eyeball e. The eye has three coats, the outermost of which is a tough white coating known as the white of the eye. The front of this, called the cornea, is transparent and acts like a window. f. The middle, or choroid layer, is richly supplied with blood vessels. It is a complete layer except for a small opening in the front called the pupil. g. The choroid layer round the pupil, called the iris, is pigmented and regulates the size of the pupil h. The innermost layer is the retina which receives the light. i. Behind the pupil is a lens which forms an image at the back of the retina This image is carried by nerves to the brain where it is translated.
II. Control of Disease	
1. Antiseptics are substances that prevent blood poisoning.	a. Bacteria entering a wound may cause blood poisoning b. Antiseptics do not kill bacteria but check their multiplication and growth. c. Dettol, carbolic acid, spirit, tincture of iodine are some of the commonly used antiseptics.
2. Disinfectants are used to kill germs in homes or environment.	a. Disinfectants are not used in or on the body b. Lysol and bleaching powder are some common disinfectants.

Major Concepts	Sub-concepts
3. Certain drugs kill bacteria within the body without harming the body.	a. Sulpha drugs are effective in stopping infections in wounds and in blood streams. b. Antibiotics are substances made by bacteria or moulds which kill micro-organisms. c. Penicillin, aureomycin, streptomycin, chloromycetin are antibiotics effective in the control of many diseases ; penicillin controls pneumonia and other diseases, chloromycetin controls typhoid fever, streptomycin controls tuberculosis.
4 Immunization practices such as inoculation and vaccination prevent the spread of certain communicable diseases.	a. The inborn ability to resist diseases possessed by our body is called natural immunity. b Immunity against small pox is achieved by vaccination. c. Inoculations are used to prevent cholera, typhoid, typhus fever, yellow fever, diphtheria, and tetanus. d. Vaccines are derived from the micro-organisms that cause the disease.
5. Milk may carry micro-organisms causing tuberculosis, typhoid, undulant fever, amoebic dysentery diphtheria, cholera and other diseases.	a. Milking and handling of milk should be done under hygienic conditions. b. Milk should be pasteurized for drinking. Pasteurization kills disease germs. c. The process of pasteurization consists in : heating milk up to 160°F for one minute, or heating up to 150°F for 30 minutes and rapidly cooling it to 50°F. d Pasteurized milk should be delivered to the consumer in sealed bottles.
6. Anaesthetics are substances used to make surgical operation painless.	a. Ether, chloroform and nitrous oxide gas are common anaesthetics used to make operations painless. b. Cocaine, novocain and others are used as local anaesthetics.

UNIT IV

SAFETY AND FIRST AID

CLASS I

Major Concepts	Sub-concepts
1. Habits of safety should be practised all day long (at all times)	Habits of safety consist of care of oneself and others when : a. walking b. bicycling c. riding in a bus or rickshaw, etc. d. playing games or with animals. e. working with tools, ovens, lamps, etc. f. bathing and swimming g. using any electrical equipment.
2. The habit of reporting and following directions about injuries and dangerous practises is an important principle of first aid.	

CLASS II

1 Habits of safety should be practised at all times.	Habits of safety consist of care of oneself and others when : a. walking b. bicycling c riding in a bus or rickshaw, etc d. playing games or with animals e. working with tools, ovens, lamps, etc. f. bathing and swimming g using any electrical equipment.
2. The habit of reporting and following directions about injuries is an important principle of first aid.	

CLASS III

Major Concepts	Sub-concepts
1. Habits of safety should be practised at all times.	Habits of safety consist of care of one self and others when : a walking b. bicycling c. riding in a bus or rickshaw, etc. d. playing games or with animals e. working with tools, ovens, lamps, etc. f. bathing and swimming g using any electrical equipment h. helping others to practise safety habits
2. The habit of sensing danger and taking precautions is a sign of developing responsibility.	Accidents can be prevented by anticipating them and taking precautions.
3. Timely treatment is necessary in all cases of accidents.	

CLASS IV

1. Safety precautions prevent accidents and injuries and are essential to individual and community welfare.	Precautions are specially needed while : i walking through busy traffic ii. handling fire in kitchen iii. handling electrical equipment iv. playing field games v. swimming b. Precautions should be taken to keep broken glass, nails, sharp instruments, poison, etc., in a place of safety.
2. Elementary first aid and emergency measures may reduce casualties.	a. Bleeding makes a person weaker. b. Bleeding can be checked by suitable methods. c. A bleeding wound requires proper antiseptic dressing. d. Insect stings and poisons are usually neutralized by ammonia or lime water.

CLASS V

Major Concepts	Sub-concepts
1. Habits of safety are essential for the individual and the community.	a. Careless throwing of burnt matches may start fires in summers. b. Fire may be put out by removing the fuel, shutting out the air supply or cooling below kindling temperature c Use a light when walking in the dark in the rainy season to avoid snakes.
2. Practising what is known and continuing to learn what to do in first aid and emergency situations is essential to good citizenship.	a Burns require protection from air and germs. b A person badly burnt requires plenty of liquids to drink. c A fractured bone should not be moved without proper support.

CLASS VI

1. Habit of anticipating accident and practising preventive measures is part of civic responsibility.	a. Fire hazards should be eliminated. b. Traffic hazards should be eliminated. c. Adherence to traffic rules prevents accidents.
2. Practising what is known and continuing to learn what to do in first aid and emergency situations is essential to survival and good citizenship.	a. Electrical equipment should be handled after switching off the current. b Bleeding can be prevented by pressure on points or by ligature. c. Warmth, fresh air, hot drinks and cheer are necessary for treatment of shock.

CLASS VII

1. Setting an example by practising safety precautions is an important duty of every good citizen.	a. Obeying safety precautions when handling dangerous objects encourages others to do likewise. b. Obeying traffic rules encourages others to do likewise.

Major Concepts	Sub-concepts
2. What is known about first aid has to be practised at all times.	a. Snake bite venom travels with blood circulation and acts rapidly on heart. b. Ligature will prevent blood from going towards the heart. c. Fractured bone requires support and rigidity by splints.

CLASS VIII

1. Setting an example by practising safety precautions is an important duty of every good citizen.	a. In any emergency, bleeding should be first attended to. b. Artificial respiration can restore respiration in many cases when it is failing.
2. Providing leadership by teaching others what is known about accidents, their prevention and first aid treatment is contribution to the community welfare.	a. Sharp objects should not be left lying about. b. Children should be kept away from high voltage electrical installations by means of fences. c. Traffic laws must be obeyed. d. Poisonous drugs must be kept away from the reach of children.

UNIT V

HOUSING AND CLOTHING

CLASS I

Major Concepts	Sub-concepts
1. Man builds a house for his home.	a. The house gives him shelter from wind, sun, rain and cold, and enemies b. The house gives comfort and convenience c. The house provides a place to store belongings.

CLASS II

1. Houses are of different types.	a. Some houses are permanent, others can be moved. b. Houses have different types of roofs : some are flat, others may be curved or sloping c. Roofs have different covering materials

CLASS III

1. A house should offer convenience and comfort.	a There should be space for eating, sleeping, study, bath and storage. b. There should be open space for children to play and for outdoor sitting in summer. c. The house should give protection from heat, cold and rain in the respective seasons. d. There should be adequate drainage of kitchen and bathroom water.
2. A house should offer safety.	a. The doors and windows should have proper bolts and bars. b. The doors, windows and almirahs should close tightly.

Major Concepts	Sub-concepts
CLASS IV	
Housing	
1. Clean, tidy, well-aired and sanitary houses are healthy.	a. A house should have free movement of air. b. A house must have enough sunlight. c. A house should be kept free from dust and dirt. d. Water should not accumulate when floors are washed. e Windows should have wire netting.
2. Different materials are used in building houses.	a. Walls are made of bricks, mud or wood. b. Roofs are made of concrete, corrugated iron or aluminium, asbastos tiles or thatch. c. Floors are made of bricks, cement or stones. d Plastering keeps the wall dry.
Clothing	
1. Clothes give protection and appearance to man.	a. Clothes protect the body from sun, rain, dust, and insect bites. b. Clothes make us look decent.
2. Different kinds of clothing are used in different seasons and climates.	a. Clothing must suit the weather and climatic conditions. b. Cotton clothes are worn in summer and woollen clothes are worn in winter. c. Some clothing absorbs the sweat from the body in the summer.
3. Cloth is made from fibres obtained from : Natural sources (plants, animals). Artificial sources	a. Cotton is obtained from the cotton plant. b. Linen is obtained from flax. c. Silk is obtained from the silk worm. d. Wool is obtained from wool bearing animals like sheep. e. The fibre is spun into yarn and woven into cloth.

Major Concepts	Sub-concepts
	f. Nylon, rayon, dacron and terylene are some of the synthetic fibres man has made.
4. Cloth is made either by hand or by machine.	a. Spining wheels and handlooms are used for making hand made cloth. b. Power looms and mills are used for making cloth faster on a large scale at less cost.
5. Clothes last longer when well cared for.	a. Proper laundering, drying, preserving and mending, make clothes last longer and serve better. b. Stains should be immediately removed by proper means. c Clothes must be washed with washing soda or soap so as to remove dirt and grease d. Clothes should be dampened before they are pressed. e. Silk clothes must be washed with good quality soap or *reetha*, and dried in shade. f. Woollen clothes should be dry-cleaned. g. Insects like silver fish destroy woollens and silk. h. Some chemicals like naphthalene and D.D.T. protect clothes from insects.
CLASS V	
1. Houses are constructed to give protection from natural forces and from enemies.	a. Roof and outside walls should be constructed to withstand wind and rain. provide coolness in summer and warmth in winter. prevent entrance of insects and vermin. b. Windows should provide adequate light. provide adequate ventilation. be screened.

Major Concepts	Sub-concepts
	c. Doors should fit tight and be provided with screens d. Drainage water outlets should have wire nets to prevent entrance of mice, rats and snakes
2. House building is influenced by climate and economy.	a. House building is conditioned by the availability of materials in the locality. b. Design, size and use of materials depend upon the money available. c. Different materials require different care (washing, polishing, painting, varnishing, creosoting and white washing). d. Areas with heavy rainfall or snowfall have sloping roofs e. Houses in hot climates have verandahs and open courtyards. f. Housing in very cold climates have well-insulated walls.
CLASS VI	
1. A building site should be carefully selected for healthy living.	a. Houses should be so planned as to permit maximum light during the day. b. A house should not be built on a low site. c. The neighbourhood should not obstruct air and light to the house. d. A good house should be located, if possible, near routes of communication.
2. A good house should have proper ventilation, light, sanitation and water supply.	a. The house should have adequate water supply free from pollution. b. There should be proper arrangements in the house for drainage of water and removal of other refuse. c. Location of latrines and urinals needs careful selection in relation to the house and the neighbourhood, and the drinking water supply.

Major Concepts	Sub-concepts
	d. Latrines and urinals should be kept clean and disinfected. e There must be proper ventilation to permit maximum movement of fresh air. f. Ample sunlight should be available within the house and the courtyard. g. The plinth of the house should be well above the street level.
CLASS VII	
1. Brick and tile are made of clay.	a. Clay is put in moulds and dried to make brick and tile. b Brick and tile are burnt in kilns to make them stronger and more resistant to water
2. From limestone, cement, concrete, quicklime, slaked lime, and white-wash are made.	a. Cement is made by heating limestone and clay in a special furnace called kiln. b. Concrete is made by mixing cement, sand, gravel and water in the right proportions. c. Quicklime is obtained by heating limestone in kilns d Slaked lime is obtained by adding a limited amount of water to quicklime. e. Mortar can be made by mixing slaked lime, sand and water in the right proportions. A better kind of mortar is made by mixing cement, quicklime, sand and water in the right proportions. f. White-wash is made by adding water to slaked lime.
3. Building materials have different properties.	a. Brick and concrete are hard and rigid. They can be given any desired shape. b. Concrete re-inforced with a matrix of iron bars bears greater stress. c. Mortar sets into a hard layer on drying. It is used for making surfaces smooth and waterproof.

Major Concepts	Sub-concepts
	d. Cement-asbestos sheets are light, fire-proof and good insulators. They are used for roofing, siding and panelling. e. Aluminium and galvanized iron sheets are light and fireproof. They are used for roofing, siding and panelling. f. Iron is used as a frame in large buildings. g. Wood is light, easily shaped and a good insulator. It is used for support for roof and in making doors and windows. h. Glass and plastics admit light, are good insulators and waterproof. They are used for doors and windows.
4. Houses need periodic repair, white-washing and painting.	a. White-washing and painting keep the walls dry and attractive. Plastic paints are more durable than white-wash b. Paints and varnishes make woodwork attractive and protect it from moisture and termites. c. Iron fixtures are painted to prevent rusting.

UNIT VI

ENERGY AND WORK

CLASS IV

Major Concepts	Sub-concepts
1. Heat is obtained from various sources.	a. Energy from the sun warms the earth directly. b. The energy of fuels is the energy of sunlight captured by plants : (i) Wood and grass are obtained from plants. (ii) Cowdung fuel is the undigested portion of plants eaten by cows. (iii) Coal, oil and natural gas are the remains of fossil plants and animals. c. Atomic energy is energy stored in the atom. d Electrical energy, which may be obtained from fuels or from water power, is a convenient source of heat. e. Friction converts mechanical energy into heat.
2. Heat is useful to man in many ways.	a. Heat is useful (i) to cook food. (ii) to keep us warm. (iii) to melt things. (iv) to produce light. (v) to dry things. (vi) to preserve things. b. Heat is used as a source of power for transport and for industrial processes. c. Heat is used in the separation of iron and other metals from their ores.

Major Concepts	Sub-concepts
CLASS V	
1. Energy is used to overcome the forces of gravity and of inertia, and the resistance of friction.	a. The earth pulls everything towards it. This pull is called gravity. b The weight of a body is the measure of the earth's gravity on it. c. A spring balance can be used to measure the weight of a body. d. A body continues to remain in a state of rest or of uniform motion in a straight line unless acted upon by an outside force. This characteristic of matter is called inertia. e Force is required to start an object moving or to stop it moving, or to change its direction of motion. f. The force required to alter the motion of a body depends upon the amount of material (mass) of the body. g. Friction is the resistance which opposes the movement of one surface over another. (i) Smooth surfaces have less friction than rough surfaces. (ii) Hard surfaces have less friction than soft surfaces. (iii) Friction between two sliding surfaces is reduced by lubrication. (iv) Rolling friction is less than sliding friction, e.g., wheel and axle. (v) Ball bearings or roller bearings substitute rolling friction for sliding friction on the axle of a wheel and axle.
2. Mass is the total quantity of matter contained in a body.	a. The unit of measurement of mass is the gram. Multiples and sub-multiples are the kilogram and the milligram respectively.

Major Concepts	Sub-concepts
	b The weight of a body at the earth's surface is a measure of the earth's gravitational pull upon its mass at that place. When measured with a spring balance this pull will vary from place to place
	c. The mass of a body remains the same anywhere in the universe, while the weight of a given mass would be quite different on the moon, for example, than on the earth. Even on the earth the weight of the same body would be different on the top of a Himalayan peak and at sea level.
3 Mass per unit of volume is the density of a substance.	a. Equal masses of different substances have different volumes.
	b. Equal volumes of different substances have different masses, because the smallest particle of a substance may be heavier than that of another. the particle may be more closely packed in some substances than in others
	c. Since one cubic centimetre of water weighs one gram, the density of water is expressed as 1 gram per cubic centimetre or as 1.
	d. The density of a substance in comparison with that of water is its relative density.
4. Objects in water are supported by a force equal to the weight of the water displaced.	a. Objects heavier than water (of greater densty), sink if placed in water ; objects lighter than water (of lesser density), float if placed in water.
	b. Floating objects sink until they displace a weight of water equal to the weight of the object.

Major Concepts	Sub-concepts
	Dense materials like iron may be shaped so that they displace much more water than they would as a solid mass. When a boat floats, its weight is the same as that of the water, which it displaces
5. Objects in any gas or liquid are supported by a force equal to the weight of the gas or liquid displaced.	a. Ships float higher in ocean water than in fresh river water. b. Some objects which sink in kerosene will float in water. c. Iron will float on mercury d Balloons filled with hydrogen will lift a heavier load than those filled with helium.
6. Work is done when a force acts through a distance.	a. Work is measured in gram-centimetre kilogram-metres (foot-pounds)
7. Disregarding friction, the work done by a machine is the same as the work put into the machine.	a In the inclined plane, the work put in is the product of the force applied and the length of the plane. b. the work accomplished is the product of the mass lifted and the height to which it is lifted.
8 The mechanical advantage of a machine is the number of times the resistance overcome is greater than the effort put into the machine In the inclined plane :	a. The mechanical advantage is the Resistance (mass lifted)/Effort (force applied) or R/E. b. Disregarding friction, the theortical mechanical advantage- Length of the plane/Height of the plane M A.=L/H.
9. The wedge and the screw are special kinds of inclined planes.	a. The wedge may be considered as a machine consisting of two inclined planes placed back to back. It is used by forcing the cutting edge into an object thereby pushing the object apart. b. The screw is a circular inclined plane. As it is turned, the sharp inclined plane moves through the material.

Major Concepts	Sub-concepts
	c. The distance between the two threads of a screw is called its pitch.
10. The lever is a simple machine that turns around a pivot or fulcrum.	a. In a lever, there is a fulcrum around which turn a resistance arm and an effort arm. b. Levers are classified according to the relative position of the effort, the fulcrum and the resistance c. The work put into a lever is the product of the eflort applied and the distance it moves. d The work accomplished is the product of the resistance overcome and the distance it moves.
11. Disregarding friction, the clockwise moment which turns the lever one way is equal and opposite to the counter-clockwise moment which turns it the other way.	a A moment is the product of a force and its distance from the fulcrum. b. Disregarding friction, the mechanical advantage of a lever is the ratio of the length of the effort arm to the length of the resistance arm. M A.=De/Dr
12. The wheel and axle, and the pulley are special kinds of levers.	Disregarding friction, the mechanical advantage of a wheel and axle is the ratio of the radius of the wheel to the radius of the axle M.A =Wr/Ar b Disregarding friction, the mechanical advantage of a pulley system is the ratio of the Effort distance to the Resistance distance. M.A.=De/Dr. It is also equal to the number of strands supporting the Resistance.

CLASS VI

I. Energy

1. Energy is the ability to do work. It is of two kinds : Potential and Kinetic.	a. Potential energy is stored energy. b. Kinetic energy is energy of motion.

Major Concepts	Sub concepts
2 Potential energy has many forms Examples are,	a. water stored at a height. b. energy stored in a bent bow or a wound spring. c. chemical energy stored in food, in fuels or in a storage battery. d. electrostatic energy of charges in a cloud e. the latent heat of steam released as the steam condenses. f. atomic energy—energy stored in the atom.
3. Kinetic energy has many forms Examples are,	a. energy of a falling body. b energy of a moving body like the automobile. c. energy of an arrow in flight d heat energy—motion of molecules. e. light energy—electromagnetic waves f sound energy—vibrations in air. g electrical energy—the energy of an electrical current or a stroke of lightning.
4 Each form of energy is either kinetic or potential or both.	a. When a boy moves downward on a see-saw or a swing, his potential energy becomes kinetic energy; as he moves up, his kinetic energy becomes potential energy. At any one time he possesses some of both kinds of energy. b. As water is forced through a penstock, its potential energy becomes kinetic energy. c. As a storage battery is charged, the kinetic energy of electric current becomes potential chemical energy; as it discharges, the potential chemical energy of the battery becomes kinetic electrical energy.
5. The different forms of energy are inter-changeable.	a. Chemical energy is changed into heat energy when substances burn

Major Concepts	Sub-concepts
	b Heat energy is changed into mechanical energy in various kinds of engines. c. Light energy is changed into chemical energy in the green leaves of plants. d. Mechanical energy, heat energy, atomic energy and light energy may be changed into electrical energy. e Electrical energy may be conveniently converted into light, heat, sound and mechanical energy.
6. Various forms of energy are used by man for getting work done.	a. Man harnesses the potential energy of water at a height, and of fuels to produce electrical power to turn the wheels of industry and for domestic purposes. b. Man produces huge quantities of standardized items with a minimum of human labour—for example, cloth, screws, bolts, auto-parts, radios, etc.
7. Various forms of energy have replaced man-energy or animal-energy in making travel and transport quicker, easier and more comfortable.	a Automobiles are replacing bicycle and carts in travel. b Steam, petrol and electric engines are used in transport. c. Turbines and motors are used to propel ships. d. Better highways are constructed using power driven machinery, to make travel faster, safer and more comfortable.
II. Heat	
1. Heat is a form of energy.	a. Heat is the motion of particles (molecules) of a substance. b. When a substance is hot, its molecules are moving rapidly ; when it is cold, its molecules are moving less rapidly.
2. Heat produces many effects on bodies.	a. Heat raises the hotness (temperature) of bodies.

Major Concepts	Sub-concepts
	b. Heat expands bodies. c. Heat brings about a change in the physical states of substances. d. Heat brings about chemical changes.
3. Heat flows from a hotter body to a colder body in contact with it.	a. Heat will flow from one substance to another in contact with it until the two are equally hot. b. Heating a solid makes the particles (molecules) of the substance vibrate faster. c The vibrating particles take up more room and the substance expands as it is heated.
4. Temperature is the degree of hotness of a body. The expansion of a substance enables us to measure temperature, for example, the hotter the material in a thermometer, the more it expands.	a Common thermometers are filled with mercury, or with coloured alcohol. Both these substances remain a liquid through a wide range of moderate temperatures, and so are appropriate for domestic purposes. b. The first thermometers used air as the expanding substance. c. Compound bars of two metals which expand at different rates are used in measuring temperature. d. Clinical thermometers have a construction which keeps the mercury up in the tube of the thermometer. e. All liquid thermometers have a sizeable bulb which opens into an uniform bore capillary tube. A little expansion of the liquid in the bulb forces the liquid a considerable distance in the capillary tube
5. The quantity of heat is measured in calories.	a. A match flame has less heat than a vessel containing water, yet the match flame is hotter than the vessel of boiling water. b. A white hot pin contains less heat than a red hot nail, yet the pin is hotter than the nail.

Major Concepts	Sub-concepts
	c. The unit of heat is the calorie, i.e., the amount of heat required to raise the temperature of one gram of water through one degree centigrade.
Transmission of Heat	
6. One of the ways in which heat is transmitted is by conduction.	a In conduction the heat is transmitted from particle to particle without the particles moving from their places. b. In conduction the rapidly moving molecules hit against their neighbours, thus speeding the latter's movement. In this way, heat is transferred by the passage of energy from one molecule to another.
7. Most metals are good conductors. Most non-metals, liquids and gases are poor conductors.	a. Most cooking utensils are made of metals which are good conductors. b. Poor conductors of heat (insulators) are useful in handling hot things and in keeping warm or cool : (i) Asbestos is one of the best solid insulating materials. (ii) Trapped still air is one of the best gaseous insulating materials.
8. Heat moves in liquids and gases chiefly by convection.	a. In convection the heated particles move from the place where they are heated to the cooler portions of the liquid or gas. Convection currents carry heat up but not down. For example, when heating a kettle of water, (i) The kettle is heated at the bottom. (ii) The molecules of water at the bottom first receive the heat. As they are heated they move faster and hence expand. The heated portion of the water then becomes lighter in weight than the cooler portions.

Major Concepts	Sub-concepts
	(iii) The heaviest cool water settles to the bottom, lifting the lighter heated water. In this way a convection current carries the heat from the bottom of the kettle throughout the entire vessel. (iv) In this way each molecule of water derives heat directly from the source. (v) Winds are convection currents in atmosphere.
9. Heat can pass through space without a medium by the process of radiation. Such heat is called radiant heat.	a. We receive radient heat energy from the sun through space. When we sit by the side of a fire, radiant heat reaches us without heating appreciably the air between us and the fire. b. Radiant heat flows in straight lines, c. When radiant heat is absorbed by a body, the body gets hotter ; the molecules in the body move faster. d. A black and rough surface absorbs radiant energy better and reflects it less than a bright smooth surface. e. A black rough surface radiates more heat energy than a bright smooth surfacc
10. A thermos flask is a vessel designed to limit the flow of heat energy through its walls by any of the modes of transmission.	a. The thermos flask is a double-walled glass vessel with a vacuum between the walls. The inner walls are silvered b. The passage of heat by conduction and by convection are almost stopped by the vacuum between the walls. c. The passage of heat by radiation is almost stopped by the mirrored surface. d. The cork also limits the transmission of heat by each of these methods.
III. Sound—How Produced and Propagated	
1. A body in a state of vibration produces sound.	a. Sounds are produced when something vibrates.

Major Concepts	Sub-concepts
	b. Vibration can often be felt or seen. c. The number of times a body vibrates per second is known as the frequency d. The human ear can hear sounds of frequencies from 20 to 20,000 per second.
2. Sound waves travel outwards from the source in all directions.	a. Vibrating objects push the air molecules around them. These molecules in turn push other molecules which surround them. b. In this way a sound wave moves out from vibrating objects.
3. A medium is necessary for sound waves to travel.	a. Sound waves travel through the air and reach the ear. b Sound waves also travel through liquids and solids.
Musical Instruments	
4. There are many ways to set an object vibrating.	a. Sounds of certain musical instruments are produced by striking or blowing. b. Plucking also causes objects to vibrate.
5. There are many kinds of musical instruments depending upon the nature of the vibrating body.	Musical instruments may be a. Stringed b. Wind c. Percussion
6. The pitch of a stringed instrument may be altered by changing—	a. the tension on the string. b. the length of the string. c. the thickness of the string.
7. The pitch of a wind instrument may be altered by changing—	a. the length of the air column. b. the method of blowing.
8. The pitch of percussion instruments may be altered to a limited extent by—	a. changing the tension on the vibrating surface. b. having different sized instruments.

Major Concepts	Sub-concepts
CLASS VII	
I. Magnetism	
1. A magnet attracts some things and not others.	a. A magnet attracts iron, steel, nickel and cobalt. b. A magnet does not attract other metals, glass, wood or other substances.
2. A magnet has two poles : a North pole and a South pole.	a. The ends of a magnet attract more than any othsr part. Those ends are called the poles. b. A suspended or pivoted magnet points north and south c. Like poles repel, unlike poles attract. d. Every magnet has a magnetic field around it.
3. Magnetism will pass through any substance except those which it attracts.	a. Magnetism will pass through glass, paper, wood, aluminium. b. Magnetic field is affected by iron, steel, nickel and cobalt.
4. Magnets may be made from steel—	a. by tapping vigorously a piece of steel in a magnetic field. by passing a current through an insulated wire coiled round a piece of steel.
5. Magnets are useful to man in many ways.	a A magnet is used in a mariner's compass to find direction. Magnets are used to detect electric currents. Magnets are used to separate constituents of mixtures.
II. Electricity	
1. Electricity is of two kinds—positive and negative.	a. Atoms are composed of small parts called electrons (negative charges) and protons (positive charges) and neutrons (neutral particles). The protons and neutrons are clustered in the centre of the atom (nucleus) with the electrons moving about it.

Major Concepts	Sub-concepts
	b. From some substances electrons or negative charges of electricity can be easily removed by rubbing.
2. Electricity produced by rubbing is called frictional or static electricity.	a. When a rod of rubber, sealing wax or plastic is rubbed with fur or wool the rod becomes negatively charged b. When a rod of glass is rubbed with silk, the rod becomes positively charged.
3. Like charges repel; unlike charges attract.	a. In rubbing a glass rod with silk, the electrons leave the rod and remain on the silk, so the silk is negatively charged. The glass rod has fewer electrons and is positively charged. b. If a rubber or plastic rod is rubbed with fur, electrons from the fur rub off on the rubber making it negatively charged. In this case the fur has a positive charge.
4. An electric current is a stream of electrons flowing from a negatively charged body to a positively charged body.	a. To make electricity flow there must be a complete path or a circuit, that is, a flow of electrons from an electrical source through a conductor, back to the source : (i) The flow of electrons in a circuit may be set up or stopped by a device called a switch (ii) Electricity flows along the path where there is least resistance. A short circuit may occur when the two wires going to an electrical device touch each other. Great heat may be produced causing fire. (iii) A fuse is a safety device that melts when the temperature reaches a critical point. b. Certain materials conduct electricity well, others do not. (i) A material that conducts electricity well is called a conductor, a material that does not is called an insulator or a non-conductor.

Major Concepts	Sub-concepts
	(ii) Most metals are conductors of electricity. Silver is the best conductor. Being cheaper, copper and aluminium are more frequently used.
	(iii) The most commonly used insulators are porcelain, rubber, plastic, paper, silk and certain types of enamel.
5. Two common methods of wiring circuits are (i) in series, and (ii) in parallel.	a. In a series circuit, the current flows through each of the devices. There is only one pathway for the electricity to move along. If any one of the devices goes out of action, all the rest will stop working.
	b. In a parallel circuit the current flowing through one device does not flow through any other. There are several pathways for the electricity to move along. So each device wired in parallel can be turned on and off independently.
6. Electricity may be produced in several ways.	a. Static charges are produced when certain materials are rubbed together
	b. In an electrical cell, a current is produced by the action of a chemical on two unlike metals or other material.
	c. In a generator, an electric current is produced from mechanical motion by the relative motion between a magnet and a coil of wire.
	d Solar cells convert light energy into electrical energy.
	e. The thermocouple convert heat energy into electrical enegy.
7. The electromagnet is a device to change electrical energy into mechanical energy.	a. A wire carrying an electric current has a magnetic field about it.

Major Concepts	Sub-concepts
	b. An electromagnet is made by winding a wire in a coil about a piece of iron and passing a current through the wire. It can be made stronger by adding more coils of wire or by passing more current in the coils Its poles can be reversed by changing the direction of the current flowing in the coil of wire. c Electromagnets are used to move things as in an electric telegraph, an electric bell, a telephone receiver, a loud speaker, an electric motor.

CLASS VIII

I. Light—A Form of Energy

1. We see things either because they give off light or reflect light received from some other source.	a. The sun, the stars, lamps and fires are seen by the light they produce. b The sun is the source of most of our light.
2. Light is a form of energy which travels in all directions from its source.	a. Most objects do not produce light. We see buildings, trees, plants and many other things by the light they reflect. b. A light in the centre of a room will light the walls of a small room more brightly than it will light the walls of a large room. c. Light travels in straight lines. d. The intensity of light varies inversely as the square of the distance from its source. e. Since the surface area of a sphere varies directly as the square of the radius, the intensity of light falling in the inside walls of hollow spheres from a light placed at the centre of these spheres will vary inversely as the square of the radii.

Major Concepts	Sub-concepts
3. Objects may be transparent, translucent or opaque	a. Substances through which object can be seen clearly are said to be transparent. b. Materials through which we cannot see but through which some light passes are called translucent ; for example, etched glass. c. Materials through which light cannot pass are called opaque.
4. An opaque body held in front of a source of light casts a shadow.	a. When the source of light is small (a point) the shadow cast is of uniform darkness. b. When the source of light is big, the shadow cast consists of a central region of complete darkness known as the umbra, surrounded by a region of partial darkness called the penumbra.
Light Reflection	
5. Mirrors and other shiny smooth surfaces reflect images, while dull rough surfaces do not.	a When a ray of light is reflected from a surface, the angle of incidence is equal to the angle of reflection. b. The reflection from a smooth surface (of an opaque body) is called regular reflection, for, the reflected rays have the same pattern as the rays of light approaching the surface. c. The reflection from a rough surface is called irregular reflection, for the reflected rays are without any order. d. Mirrors may be plane, concave or convex—according to whether the reflecting surface is plane or curved.
6. When rays of light from a point appear to diverge from another point, or meet at another point after reflection,an image is formed.	a. When an image is formed due to divergence of reflected rays from a point, it is called a virtual image. It cannot be seen on a screen.

Major Concepts	Sub-concepts
	b. When an image is formed due to the convergence of reflected rays to a point, it is called a real image It can be seen on a screen
7. Regular reflection from mirrors may give rise to images of different nature.	a In a concave mirror a parallel beam of light rays, after reflection, passes through a point in front of the mirror called the 'focus'. The distance of the mirror from the focus is called the 'focal length'.
	b In a convex mirror a parallel beam of light rays appears to diverge from a point behind the mirror called its 'focus'. The distance of the focus from the mirror is called the 'focal length'
	c. A plane mirror forms images which are virtual, erect and of the same size as the object, but are laterally inverted
	d A convex mirror always forms a virtual, erect and a diminished image of a real object
	e. A concave mirror forms an enlarged, erect and virtual image when the object is closer to the mirror than the focus
	f. A concave mirror forms an inverted, real image when the object is farther from the mirror than the focus.
8. Mirrors are put to various uses.	a. A plane mirror is used as a looking glass, to read type composed for printing, in a periscope and in certain sensitive scientific instruments such as a galvanometer.
	b. A concave mirror is used as a reflector in headlights, as a shaving mirror, in instruments used by a doctor or a dentists, and in projection apparatus.
	c Convex mirrors are used as rear view mirrors in various types of vehicles.

Major Concepts	Sub-concepts
Refraction	
9. The bending of a ray of light as it passes from one medium to another is called refraction.	a. A ray of light passing from a rarer medium into a denser medium bends towards the normal (a perpendicular to the surface of contact of the two media). b. A ray of light passing from a denser medium into a rarer medium bends away from the normal. c. A ray of light passing through a prism bends towards the base as it enters the prism and as it leaves the prism. d. Refraction causes many illusions : (i) An object under water appears raised when seen from above. (ii) A stick partially immersed in water appears bent.
Light—Colour	
10. Sunlight is composed of light of seven colours.	a. Sunlight passing through a prism is dispersed into several component colours : red, orange, yellow, green, blue and violet. b. The red rays are deviated least and the violet rays most. c. A rainbow is the result of the dispersion of sun light in the water drops of a cloud or shower. It is seen when the sun is behind the observer and the shower is in front of him
11. The colour of an opaque object depends upon which of the colours of white light it reflects to the eye.	a. If it reflects all of the colours it receives. it appears white, if it absorbs all of the light it receives, it is black. b. The colour of an opaque object also depends upon the colour of the light shining on it.
12. The colour of a transparent object depends upon which of the colours pass through it.	a. A red glass, for example, transmits red colour and absorbs most of the light of other colours.

Major Concepts	Sub-concepts
	b. Different coloured lights may be combined by placing glass of one colour in front of one projector, another in front of a second projector and then shining both projectors on a single object.
	c Beams of red, green and blue light may be combined to produce white light.
Lenses	
13 Lenses are of a transparent material with spherical surfaces which refract light.	a. They may be convex (bulge in the middle). A convex lens may be regarded as two prisms with their bases towards each other.
	b. They may be concave (thinner in the middle). A concave lens may be regarded as two prisms with their apices towards each other.
	c. A convex lens causes parellel light rays to converge to a point called a focus; a concave lens causes parallel light rays to diverge
	d. The distance of the focus from the centre of the lens is called its focal length.
14. Lenses produce different kinds of images. The image may be—	a. real or virtual
	b erect or inverted.
	c. enlarged or diminished.
15. In a convex lens, the object and its images have certain relationships.	a When the object is located between one and two focal distances from the lens, the image is enlarged, inverted and real.
	b. When the object is located more than two focal distances from the lens, the image is formed between one and two focal distances from the lens. It is diminished, inverted and real.
	c. When the object is located less than one focal distance from the lens, the image is erect, enlarged but virtual.

Major Concepts	Sub-concepts
16. A lens or a combination of lenses have many applications in life.	a. A convex lens is used as a burning glass. b. A convex lens is used as a magnifying glass. c. A convex lens is used in a photographic camera. d. A compound microscope is a combination of convex lenses, object glass and eye piece. The object which is between F and 2F of the object glass produces an enlarged image which, being between the eye piece and its focus, produces an enlarged virtual image. e. A telescope is a combination of two convex lenses—the object glass and the eye piece The distant object, which is much beyond 2F of the object glass, produces a diminished image between eye piece and its focus. The eye piece then produces an enlarged virtual image.
17. The eye has a convex lens In fact, the eye and the camera are alike in many ways.	a. The lens forms an image on the retina at the back of the eye. b. The parts of the eye and the camera correspond as follows : eye — camera eyelids — shutter iris — iris lens — lens retina — film
18. Either one or both eyes of a person may be imperfect in structure and need correcting	a. The retina may be too near or too far away from the lens causing blurred images. (i) Short-sight is rectified by using a concave lens. (ii) Long-sight is rectified by using a convex lens.

Major Concepts	Sub-concepts
	b. Other eye defects may be due to an incorrectly shaped eye ball or to weak muscles. Properly fitted glasses may prevent eye strain c. Healthy corneas may be transplanted to overcome certain kinds of blindness. d. Trachoma can be prevented by proper care of the eyes.
II. Work and Energy (Engines)	
1. New machines and new forms of energy improve our living conditions.	a. Wind and flowing water were the first forms of energy used to do work without the use of muscles. b An important early discovery was the advantage of the wheel in using the energy of wind and flowing water. c. Machines were invented which could use the energy of flowing water and moving air to do many tiring jobs quickly and easily d. Now turbines turned by the energy of flowing water drive electric generators, which produce electric power.
2. Modern steam engines are of two types—the wheel type and the piston type.	a The wheel type of steam engine is called a steam turbine. b. When blades on a wheel are pushed by steam, the wheel spins. c. In the piston type of steam engine the steam is let into a large tub called a cylinder. The piston which fits tightly inside the cylinder moves in and out when pushed by steam. The piston moves a rod that turns a wheel. d. The steam for the steam engine is produced in a boiler fired by coal or oil. In locomotives the hot gases from the fire pass through tubes inside the boiler. In most power plants the hot gases pass around water filled tubes.

Major Concepts	Sub-concepts
3. In a petrol (gasoline) engine, power is obtained from the burning of petrol in a cylinder.	a. In a petrol engine a spark plug produces an electric spark that sets fire to a mixture of fuel and air which burns in the cylinder. b. Each explosion pushes the piston in the cylinder The motion of the engine brings the piston back again. c The piston pushes a rod that turns a crank shaft which in turn, turns the wheel. d. In automobile engines there are several cylinders coupled together to work as one engine e. In each cylinder there are four strokes for each explosion namely, intake, compression, power, exhaust.
4. A diesel engine works something like a petrol (gasoline) engine but it uses a fuel oil and has no spark plug.	a. Air is drawn into the cylinder. This air is compressed As it is compressed, it is heated. b. A jet of atomized fuel oil is injected into the engine at just the right time.
5. In a gas turbine, heat energy is used to turn a wheel with many blades on it.	a. Until recently all aeroplanes were driven by piston engines. Now most aeroplanes are driven by turbo jets. b. The blades are pushed by expanded hot gases.
6. A jet engine has two main parts—an air pump and a gas turbine	a. The air pump draws in air and compresses it. b. The gas turbine uses some of the energy of exhaust gases to drive the air pump. c. The rapid expulsion of hot exhaust gases gives thrust.
7 A jet engine gets its name from the stream (or jet) of compressed air and burnt gas which rushes out behind the engine.	a. Jet engines are lighter for their power than are conventional engines. b In a conventional plane, the tip of the propellers exceed the speed of sound long before the plane reaches that velocity. Thus jet planes can go faster for they are not held back by the drag of the propellers.

Major Concepts	Sub-concepts
8. A rocket engine carries its own oxygen as well as its fuel	a. To fly to the moon a rocket engine would be needed. b. When the fuel and oxygen meet and burn in the combustion chamber of a rocket engine, they produce great quantities of heat and compressed gases, which push the rocket plane forward.
9 The 25,000 m.p.h. speed needed to escape from the earth's gravity is attained by using a three stage rocket.	a By using several stages, useless mass is discarded and the small 'pay load' can be made to move faster b. To orbit the earth an object has to get high enough and go fast enough at this height, so that even though it is falling towards the earth all the time—it travels so fast that it keeps on going round the earth c Rockets may attain a speed of 25,000 m p.h.
10. The atomic energy in radium is given off in flashes for thousands of years.	a. Each atom has one flash of atomic energy b Different atoms flash yielding energy at a predictable rate.
11. Scientists have found a method of making a vast number of atoms give off their energy all at once yielding an enormous amount of light and heat.	a. When several small pieces of Uranium 235 or plutonium are brought close together under certain conditions, they set off a quick atomic flash. b. Neutrons from the flash cause nearby atoms to give off their energy, which in turn produce other neutrons. These in turn cause still other atoms to give off energy. This is called a chain reaction.
12. Scientists can increase or decrease the speed of this chain reaction	a In a bomb, the chain reaction is made to occur rapidly. b. Chain reactions can be slowed down so that the heat can be used for making steam to drive a turbine. c. A reactor is a machine in which the chain reaction is slowed down.

Major Concepts	Sub-concepts
13. Scientists have discovered many uses of atomic energy.	a. Since atomic fuels give off large amounts of energy for their weight, a very small amount of fuel can run an engine for a long time.
	b. Atomic energy may eventually lower the cost of electricity also. It may be used where other sources of power are not available.
	c. Scientists have made life easier by improving health, increasing food production, and developing automatic manufacturing.
	d Many scientific discoveries can be good or bad for human beings, depending on how the discoveries are used.
III. Electricity	
1. Electricity may be measured in various ways.	a. The amount of current flowing in a circuit is measured in *amperes*.
	b. The electrical pressure of a current flowing in a circuit is measured in *volts*.
	c. The resistance of a circuit to the flow of current is measured in *ohms*.
	d. The *amperes* of current flowing in a circuit is directly proportional to the *volts* and *ohms*. $A=V/O$
	e. The power flowing in a circuit is measured in *watts*. One watt is equal to a current of one ampere flowing through a difference of one volt. $W=A\times V$. One kilowatt is 1000 watts.
	f. The electrical energy consumed is measured in kilowatt-hours. One kilowatt-hour is a kilowatt of power flowing for one hour
2. Currents are induced in electrical circuits, whenever there is relative motion between a conductor and a magnetic field. Several kinds of devices are used to induce electrical currents.	a. In a *magneto* a coil of wire is rotated between the poles of permanent magnets : A magneto generates an alternating current.

b. In a dynamo or a generator, a coil of wire is rotated in the field of an electro-magnet or the electro-magnet is rotated in a coil of wire. An alternating current is generated in the coil and this current may be converted into a direct current by means of a split ring commutator.

c. In a magneto or a dynamo, the induced current is such that it builds up a magnetic field that opposes the motion. In this way, mechanical energy is converted into electrical energy by the use of magnetism

d. In a transformer, an alternating current in the primary coil produces a moving magnetic field in a secondary coil, thus inducing a current in the secondary coil.

e. In a coil, such as the induction coil used in the ignition system of an internal combustion engine, a low voltage current from a storage battery is interrupted, thus moving a magnetic field around the primary coil This moving magnetic field induces a current in the secondary coil.

3. A condenser is a device which permits electricity to be temporarily stored and then quickly discharged.

a. In a condenser two metal plates are separated by a thin insulator Electric charges on one plate affect those on the other plate.

b. A condenser across the breaker points controlling the current in the primary circuit of a coil stop the current quickly —thereby changing the magnetic field faster and thereby inducing a higher voltage current in the secondary.

4 Electrical energy may be transmitted over long distances by sending a large amount of power (kilowatts) with a relatively small current (amperes). Watts=Amperes=Volts.

a At the power plant a current of usually 440 volts is generated. A step-up transformer then increases this voltage to 66,000; 1,32,000 or even 2,20,000 volts.

Major Concepts	Sub-concepts
	b. High tension lines distribute the electricity to regional power stations where, step-down transformers reduce the volts.
	c Near each locality or small commercial consumer a step-down transformer further reduces the voltage to 220 volts or 440 volts.
5. Electric motors are devices which convert electrical energy into mechanical energy.	a. Electric motors are turned by the push and pull of the magnetic fields in the motor The magnetism from the field magnets operates to turn the rotating magnets.
	b. A split ring commutator is used to reverse the direction of the current in the rotating magnet (armature) at the proper time to keep the field magnets pulling and pushing the armature magnets in the same direction at all times.
	c. Motors vary in size from tiny ones used in toys to giant ones used in huge locomotives.
	d Since motors can be made in all sizes, they are widely used to operate all kinds of household appliances, and industrial installations where mechanical energy is required.
	e. Some household appliances which use motors in various ways are :
	1. Vacuum cleaner—turns a fan creating air current which collects dust instead of stirring dust around as a broom does.
	2. Refrigerator—turns a compressor which pumps refrigerant from evaporator to a condenser – thus cooling the refrigerator and making possible the storage of perishable food.

3. Washing machine—motor drives agitator thereby forcing wash water through clothes. It also dries the clothes by means of a wringer or by spinning them.
4. Power pump—motor turns pump thereby lifting water.
5. Electric fan to turn blades

6 The telephone enables one to talk with someone at a distance The essential parts of a telephone are a transmitter, and a receiver.

a. The transmitter converts sound waves into a varying electric current. Changes in pressure on a box of carbon granules change the resistance in an electric current so that it corresponds to the waves
b. The receiver converts varying electric current back into sound wave by the action of an electromagnet on a steel diaphragm.
c. An amplifier is used to make possible transmission over a greater distance.

7. The gramophone reproduces music by converting the wave placed on a thin disc into music. It consists of four essential parts.

a. An electric motor or a mechanical device turns a turn-table at a constant speed.
b A pick up arm with a small microphone in it converts the mechanical motion of the needle into a varying electric current.
c The varying electric current is amplified as in a radio.
d. The varying amplified current is passed into a loud speaker, where an electro-magnet operating in a magnetic field moves a diphragm, producing sound waves.

8. A tape recorder records and plays back the voice or music on a magnetic tape

a. An electromagnet changes the magnetic pattern on a tape to correspond to a varying current produced in a microphone.

Major Concepts	Sub-concepts
	By moving the tape through a receiving head (coil), a current is generated in the coil which corresponds to the pattern on the tape. This current is then amplified and sent through a loud speaker as in the gramophone.
9. A radio transmits energy via electro-magnetic waves making possible the sending of messages without wires.	a. A sending station produces an oscillating current of a particular high frequency between the earth and the antenna . (i) This oscillating current generates an electromagnetic wave around the antenna which wave spreads out in all directions. This wave is known as a carrier wave. Its frequency is from 550 kilocycles to 15,000 kilocycles (Radio frequency). (ii) This oscillating current is modulated by means of a transformer which carries audio frequency waves generated by a microphone. The amplitude of the carrier waves varies as the sound waves picked up by the microphone b. The electro-magnetic radio wave sets up an oscillating current in the radio antenna—between the antenna and the ground (the chassis of the receiving set). This varying signal is passed through a coil (a transformer without an iron core) where its variations are sent to the grid of a radio tube. c. The varying voltage on the grid of a radio tube is used to vary the electrons escaping from the filament to the plate of the tube. In this way the magnitude of the variations is magnified thousands of times. This magnified current may be sent into the grid of other radio tubes—again stepping up the magnitude of the variations.

Major Concepts	Sub-concepts
	1. The first radio tube valve transformer circuit screens out the carrier wave and converts the modulations into a varying direct current. 2. Condensers are used to vary the capacity of the circuit thereby tuning to particular stations.

UNIT VII

MATTER AND MATERIALS

CLASS V

Major Concepts	Sub-concepts
1. All matter takes up space. It exists in three different states—solids, liquids and gases.	a. Solids have definite shape and volume. b. Liquids have definite volume, but no definite shape. c. Gases have neither shape nor definite volume.
2. All matter is made up of small particles called molecules.	a. Molecules are so small that they are not visible to the naked eye. b. The molecules that make up matter are always in motion
3. We can account for the three states of matter by assuming that gas molecules have more energy than molecules in a liquid state, thus the molecules of a liquid have more energy than molecules of solid.	a. Some molecules are not as free as others to move about. b. Molecules in a solid have less energy to move about than in a liquid and so solids have a definite shape. c. Molecules of gases move most freely of all.
4. The three states of matter are interchangeable.	a. Energy is absorbed when a solid changes to a liquid or when a liquid changes to a gas.
5. When a solid dissolves in a liquid, it splits up into tiny particles which diffuse uniformly through the liquid.	b. Energy is released when a gas condenses, or when a liquid freezes. a. A particle of potassium permanganate put in water colours the entire water b. Sugar dissolves in water with practically no increase in the volume
6. A molecule is made up of still smaller particles called atoms.	a. Molecules of gases like hydrogen, oxygen and others consist of two atoms of the same kind. b. Molecules of carbon dioxide, water and others consist of different kinds of atoms combined together.

Major Concepts	Sub-concepts
CLASS VI	
1. Eleme ts are substances whose molecules are made up of the same kind of atoms Materials can be separated into their elements.	a. There are about 90 natural elements. b. Man has made some other elements and there are now over 100 known elements.
2. A compound is a substance whose molecules consist of two or more kinds of atoms.	a. The molecules of a compound are all alike. b. The constituents of a compound cannot be separated by mechanical means. c. The properties of a compound are different from those of its constituents. d. The constituents of a compound are always in a definite proportion.
3. A mixture is a substance whose molecules are of different kinds.	a. The components of a mixture can be separated by physical means. b The properties of a mixture are an average of those of its components. c. The components of a mixture may be in any proportion.
4. Matter undergoes changes These changes may be physical or chemical.	a. When a physical change takes place—no new substances are formed. b. When a chemical change takes place new substances are formed.
Materials in Daily Use	
1. Soap and detergents are used for cleaning purposes.	a Soap is formed by the action of caustic soda or caustic potash on a vegetable oil or fat b. Soap forms many bubbles which attract dirt particles c. The soap breaks up the oily layer physically and dissolves the greasy matter. d. Toilet soaps are less caustic than washing soaps. e. Modern detergents do not contain soap but serve the same purpose

Major Concepts	Sub-concepts
2. Matches are used to make fires easily	a. Different substances catch fire at different temperatures known as ignition point or kindling temperature. b. Red phosphorus has such a low kindling point that it glows by the heat of friction. c. The temperature at which red phosphorous glows is sufficient for antimony sulphide to catch fire d. The burning of antimony sulphide produces a temperature at which paraffin and the soft wood of the match-stick catches fire. e. In safety matches, the side of the match box is coated with a mixture of red phosphorous (a low kindling material) fine sand (for friction) and glue (for holding it). The match stick is made of soft wood soaked in molten wax (to make it more inflammable), and the tip of the stick is coated with antimony sulphide, powdered glass and glue.

CLASS VII

Air

1. At the surface of the earth the air consists of about one-fifth oxygen and four-fifths nitrogen. It also contains varying amounts of water vapour and dust.	a. Oxygen is removed from the air when metals rust, fuels burn, or respiration occurs. (i) Oxygen may be completely removed from a jar of air by the rusting of iron or by the burning red phosphorus. (ii) A burning candle stops burning when about one-fourth of the air is removed from a jar of air. b. When oxygen is removed from the air, the remaining gases are mostly nitrogen. (i) Nitrogen is called an inert gas because it does not support combustion.

Major Concepts	Sub-concepts
	(ii) Nitrogen does not easily combine with other elements. (iii) But for the variation in water content, the composition of the air remains quite constant. c. The water vapour content of the air varies (i) It depends upon geographic factors (whether over land or sea). (ii) It depends upon the temperature. The warmer the air the greater its water holding capacity. When cold moist air is heated, it becomes hot dry air.
Oxygen	
1. Oxygen is widespread at the surface of the earth.	a Oxygen gas from air dissolves in water. b. Oxygen is a constituent of water. c. Oxygen is a constituent of most rocks and minerals. d. Oxygen is a constituent of most organic matter.
2 Oxygen is obtained by heating some substances and by electrolysis of water. It is obtained by :	a. heating certain oxides (Red Lead). b heating compounds like potassium nitrate, potassium chlorate, potassium permanganate. c. heating a mixture of manganese dioxide and potassium chlorate. d. The electrolysis of water.
3. Oxygen is identified by its property of supporting combustion	a. A glowing splinter introduced into a jar of oxygen, bursts into flame. b. A burning candle will burn very brightly in a jar of oxygen.
4. Oxides are formed when elements burn in oxygen.	a. Some of the oxides are acidic, turning blue litmus red. b. Some of the oxides are alkaline, turning red litmus blue.

Major Concepts	Sub-concepts
5. Man uses oxygen in many ways.	a. Oxygen can be stored and used for artificial respiration by persons not able to breathe oxygen from air normally, e g , (i) mountaineers. (ii) air men. (iii) fire fighting squads. (iv) patients. (v) divers and crew in submarine.
	b. Oxygen can be used to produce a high temperature to melt metals as in the oxy-hydrogen or oxy-acetylene flames.
Hydrogen	
1. Hydrogen is widespread at the surface of the earth.	a. Hydrogen is a constituent of water. b. Hydrogen is a constituent of many rocks and minerals. c. Hydrogen is a constituent of all organic matter. d. Hydrogen is a part of all acids.
2. Hydrogen is prepared from water or acids.	a Hydrogen is prepared by electrolysis of water. b. Hydrogen is prepared when dilute hydrochloric acid is added to zinc. c. Hydrogen can also be prepared by the action of magnesium or sodium on water.
3. Hydrogen combines with other elements to form many compounds.	a. Water is formed when hydrogen is burnt. b. Hydrogen combines with chlorine to form hydrochloric acid.
4. Hydrogen has characteristic properties.	a. Hydrogen is the lightest gas. b. Hydrogen is combustible and burns with a pale blue flame. Hydrogen does not support combustion.

Major Concepts	Sub-concepts
5. Hydrogen is used in many ways.	a. Hydrogen is used by meteorologists in balloons. b. Hydrogen is used in welding (oxy-hydrogen flame) c. Hydrogen is used in the hydrogenation of the oils

Carbon dioxide

1. Carbon dioxide is formed by the union of carbon with oxygen It is formed when—	a. any carbon fuel burns. b. any organic matter decomposes. c. sugar solutions ferment. d. respiration occurs.
2 Carbon dioxide is prepared from carbonates.	a. When lime-stone is heating strongly, it changes to quick lime and carbon dioxide. b. By adding acids to limestone or marble or washing or baking soda.
3. Carbon dioxide has characteristic properties.	a. Carbon dioxide is heavier than air b. Carbon dioxide is not combustible c. Carbon dioxide is a non-supporter of combustion. d. Carbon dioxide turns lime water milky, which is a test for this gas e. Carbon dioxide dissolves in water to give a weak acid called carbonic acid.
4. Carbon dioxide is used in many ways. It is used in—	a. extinguishing fires b making aerated carbonated water c. as refrigerant (dry ice) d. to inflate safety belts and rafts.
5. Plants maintain the balance of carbon dioxide in air.	a. Carbon dioxide is continuously added to the air by burning and by respiration of every living creature. b. Carbon dioxide is continuously removed from the air by green plants in the process of photosynthesis.

Major Concepts	Sub-concepts
	c. Within limits, as the carbon dioxide content of the air increases, the rate of photosynthesis increases and plants grow more luxuriously.
	d. The carbon dioxide content of air thus remains at a constant level (04%).
Acids, Bases and Salts	
1. Acids have certain properties in common. Hydrochloric, sulphuric, nitric and carbonic are a few common acids.	a. Acids turn blue litmus paper red. b Acids are sour to taste. c. Acids generally dissolve metals giving off hydrogen and forming salts. d. Acids neutralize alkalies forming salts and water.
2. Alkalies have certain properties in common. Sodium hydroxide and potassium hydroxide are strong alkalies. Calcium hydroxide and ammonium hydroxide are mild alkalies	a. Alkalies turn red litmus paper blue. b. Alkalies are caustic to taste, and feel soapy to touch. c. Alkalies neutralize acids forming salts and water.
Materials in Daily Use	
1. Glass is an indispensible material in modern life.	a Glass is made by heating together sand, washing soda and limestone. b. Glass is transparent, a poor conductor of heat, but is brittle and easily broken. c. Waste glass can be used again as raw material for the manufacture of glass. d. Glass is used as a building material, a decorating material, in various articles of domestic use
2. Porcelain is used for many purposes	a Porcelain is made from kaolin. b. Porcelain vessels can be glazed and decorated
CLASS VIII	
1. Metals occur in nature as an element or in a combined state.	a Gold and sometimes silver occur as free elements b. Other metals occur as ores from which they are extracted.

Major Concepts	Sub-concepts
2. Extraction of gold is a process of concentration and separation of the metal from the sand or hard rock.	a. Gold nuggets occur in some rocks. b. Most gold is found as fine grains in alluvial sand c. The heavier gold particles are separated by washing with moving water.
3. Iron is separated from its oxide ore by reducing them at a high temperature with coke and limestone.	a. Pig iron is obtained when these raw materials are heated in a blast furnace. b. Coke burns to produce a high temperature. It combines with the oxygen of the ore leaving the metal free. c. The limestone combines with the rock impurities and removes them as a molten slag. d. A blast of hot air is blown into the furnace to hasten combustion. e. The hot gases from the furnace are used to heat the blast of air. f. Cast iron and wrought iron are obtained by heating and burning the carbon out of pig iron in a furnace. (i) Cast iron contains quite a bit of carbon. (ii) Wrought iron is nearly pure iron. g. Carbon steel may be made by burning nearly all the carbon out of the pig iron in a Bessemer Furnace. h. Different steels are made by burning nearly all the carbon out of the pig iron in a furnace and then adding the requisite amount of carbon or one or more other metals such as nickel, chromium, cobalt, manganese or silicon. i. Scrap iron is also used in making steel. It is a source of the particular metals needed. Scrap iron should be consumed.

Major Concepts	Sub-concepts
4. The passage of electricity through some compounds, or solutions of compounds separates the compound into its elements. This process is called electrolysis.	a. During the electrolysis of water, hydrogen is released at the negative electrode (cathode) and oxygen is released at the positive electrode (anode). b. During the electrolysis of a salt the metallic part collects at the cathode and the non-metallic part goes to the anode. c. The electrolysis of a certain metallic salt may be used to deposit the metal of that salt on another metal. This is called electroplating.
5. Aluminium is separated from its oxide in an electric furnace by electrolysis.	a. Aluminium oxide is prepared from its ore, bauxite, by crushing the ore and washing out the sand with water. b. Aluminium oxide is dissolved in molten cryolite at a temperature slightly less than 1000°C. c The huge current between two graphite electrodes melts the cryolite which dissolves the aluminium oxide. By electrolysis, oxygen is separated from the ore. The molten aluminium collects at the bottom of the furnace, from where it is removed.

UNIT VIII

LIVING THINGS

CLASS III

Major Concepts	Sub-concepts
1. There are many kinds of living things.	a. A human being is a living thing. b. All animals are living things. c. All plants are living things.
2. Living things exhibit certain characteristics. (All living things grow, multiply and die.)	a. Living things grow. b. Living things respire c. Living things respond to stimuli. d. Living things reproduce themselves. e. Living things die.
3. Plants and animals differ in many ways.	a. Green plants make their own food from simple materials and solar energy. b. Non-green plants depend on other living things for their food. c. All animals depend ultimately on plants for their food (i) Some animals eat plants (ii) Some animals eat other animals which eat plants. (iii) Some animals eat other animals which eat still other animals which in turn eat plants. (iv) Some animals eat both plants and animals. d. Most plants cannot move by themselves. e Man has the characteristics of an animals.

CLASS IV

1. Plants live in different types of surroundings.	a. Certain plants live on land and certain plants live in water. b Certain plants grow only in places which are hot and humid. c Certain plants grow only in cold regions.

Major Concepts	Sub-concepts
	d. Certain plants grow only in arid regions.
	e. Certain plants grow on marshy lands.
2. Plants show special characteristics fitted to their surroundings.	a. Certain water plants generally possess structures which make them float.
	b. The stems of some water plants are elongated which keeps their leaves above water.
	c. The shape, size and position of leaves of different plants are so arranged that they catch a maximum amount of sunlight.
	d Arid area plants have small or thick leaves and thereby conserve water.
	e. The roots of plants are so arranged that they get water and mineral salts.
3. Animals live in different types of surroundings.	a. Some animals live in hot regions ; some animals live in cold regions.
	b. Some animals live in holes in the ground
	c. The skin of animals suits the temperature range and environment in which they live.
	d. The skin of the animals is so made that it protects the animals from extreme dryness.
4 Animals are fitted to capture the food they eat.	a. Birds which pick and pierce have hard beaks.
	b. The mouth parts of different animals are shaped according to their food habits.
	c. The limbs of many animals are shaped according to their food-capturing habits.
CLASS VIII	
1. The unit of life is a cell.	a. A cell is microscopic in size.
	b. The major part of the cell is protoplasm, which consists of a nucleus and cytoplasm.
	c. Some living things are unicellular and others are multicellular.

Major Concepts	Sub-concepts
2. Many micro-organisms are unicellular.	a. Bacteria and yeast are unicellular plants. b Amoeba and paramecium are unicellular animals. c. Unicellular micro-organisms reproduce by cell division. d. Green micro-organisms make their own food. e. Many micro-organisms exist on dead organic matter. These are called saprophytes f. Many micro-organisms live on other living organisms (hosts). These are called parasites. g. Parasitic micro-organisms cause disease in hosts.
3. Man uses micro-organisms for various purposes.	a. Yeast is used in making bread, wine, biscuits and *jalebi*. b. One type of bacteria changes milk into curd. c Certain types of bacteria enrich the soil.
4. Multi-cellular organisms have a complex organized structure of several kinds of cells.	a Every cell carries on certain vital processes namely assimilation of food, growth, respiration, excretion and reaction to stimuli. b. Every cell also carries on certain specialized functions.
5. Heredity is the transmission of the character of parents to their offspring	a. Each individual starts as a fertilised egg cell. b. The male parent furnishes the sperm and the female parent furnishes the egg. c. The union of the sperm and the egg results in the fertilized egg. d. The characters of the parents are passed on to the offspring through these sex cells.

Major Concepts	Sub-concepts
6. Inherited characters are transmitted according to definite biological laws which were first formulated by Gregor Mendel.	a. Different individuals have different characters. In Mendel's peas there were variations in the size of the plants, smoothness of seeds, and colour of seed coats. There are also variations in animals, for example in humans—the colour of hair, straight or curly hair, skin pigmentation, height; in guinea pigs—the colour of coat, length of fur, spotted or solid colour; in dogs, head carriage, head length, hair length, foot length. b. When individuals with different characters were crossed, the hybrid offspring resembled one parent (for example, all the peas were tall or all were smooth, or all had yellow seed coats) This, Mendel called the Law of Dominance. The characters which did not show in the first generation were called recessives c. When the hybrid individuals were crossed among themselves, the offspring showed the dominant and recessive characters in the ratio of 3 : 1. This is known as the law of segregation. d. The different characteristics such as tallness and shortness or smoothness and wrinkledness are inherited independently This, Mendel called the Law of Independent Assortment. e. These laws are useful in explaining many aspects of heredity in plants and animals.
7 Cross-breeding may be used to improve the quality of animals ; off-spring with undesirable qualities may be rejected.	a They may be stronger, or run faster b. They may yield more milk, eggs wool or meat. c. They may look better. d. They may be resistant to diseases or climates.

Major Concepts	Sub-concepts
8 All the present day life on earth is believed to have developed from a common ancestry	a All living things are alike in many respects. b. Striking similarities of structures seen in animals cannot be accidental : (i) Skeletons and muscles of vertebrates show similar corresponding parts. (ii) The digestive organs of vertebrates show similar structure and functions. (iii) The circulatory and respiratory organs show similar structure and functions. c. Fossil records of past life show that living things have become increasingly varied and specialized with the passage of time : (i) Early fossils are mostly gastropods, brachiopods or trilobites. (ii) Fishes were the first vertebrate fossils (iii) Reptiles, birds and mammals appeared much later. (iv) The modern one-toed horse evolved from an ancient four-toed animal about the size of a fox, in the course of an estimated period of fifty million years. d. The changes in livings things that occur in vast periods of time constitute evolution. e. Darwin accounted for evolution : (i) Each kind of living thing (species) produces many more offsprings than can possibly survive. (ii) There is a variation among the offspring. (iii) Some individuals are better fitted to survive than others. (iv) Natural selection follows. Those best fitted to survive become parents of future generations.

UNIT IX

PLANT LIFE

CLASS I

Major Concepts	Sub-concepts
1. Plants around us are of different varieties.	a. Plants are of different sizes. b. Plants are of different shapes. c. Most plants have leaves. d. Some plants have thorns. e. Some plants grow into tall trees. f. Some plants grow as creepers g. Some plants spread out while others go straight up
2. Many plants grow out of seeds.	a Many plants bear flowers, fruits and seeds b. Seeds are small plants which have food stored in them. c. Seeds germinate when they get warmth and moisture.
3. Many food articles are obtained from plants.	a. We get food grains (cereals and pulses) from some plants. b. We get fruits from some plants. (mango, banana, citrus, guava). c. We get vegetables from some plants (cauliflower, cabbage, tomato, peas, beans).

CLASS II

1. Man grows plants that are useful to him.	a. All parts of some plants are edible. b. Leaves (spinach) of some plants are used as food by man and other animals. c. Leaves of some plants are used to prepare drinks (tea, *tulsi*). d. Dead and fallen leaves of plants may be used as a source of manure. e. Tubers of some plants are used as food

Major Concepts	Sub-concepts
	f. Fruits (mango, banana), seeds (groundnut, pea), grain (wheat, rice, maize) of many plants are used as food. g. Stems (sugarcane) and flowers (*Moringa*, banana, *Bauhinia*, *Sesbania*) of some plants are used as food. h Some plants yield seeds (sesame, mustard, cotton, groundnut) from which oil is extracted. i. From some plants we get medicines (*Cinchona*, *neem*, opium, *Adhatoda*, *banafsha*) perfumes (rose, *jasmine*), gums (*Acacia*) and rubber (*Havea*) j. Flowers (Aster, Calendula) and leaves (mango, banana, *ashoka*) of some plants are used for decoration k. Some thorny plants are used as hedges (*Lawsonia*, *Inga*, *Duranta*) l. Wood from some trees (teak, *shisham*) is used for building and furniture and that from others as fuel. m. Some plants yield fibres including paper.
2. Plants can be classified according to size and shape.	a. Plants may be called trees, shrubs, or herbs, according to their size. b. Plants may be called creepers or twiners if their stems are not erect.
3. Some plants are short-lived while others live for a long time.	a. Trees, shrubs and many herbs are long-lived. b. Cereals, most vegetables and garden flowers last only one season.
CLASS III	
1. A plant has different parts.	a. A root is the part of plant which is under the soil. b. The stems, leaves, flowers and fruits are the parts of a plant that are above the ground.

Major Concepts	Sub-concepts
2 Different parts of a plant have different functions.	a. The root holds the plant in position firmly. The plant gets its water and minerals from the soil through the root. b. Water and minerals in solution pass through the stem to the different parts of the plant. c. The green leaf prepares sugar with water from the roots and carbon dioxide from the air in the presence of sunlight. d. The food manufactured in the leaves passes through the stem to all parts of the plant. e. Materials from the soil and those manufactured in the leaves are used for the growth of the plant. f. Many plants bear flowers which give rise to fruits and seeds.
3. Man uses seeds to grow plants that are useful to him.	a. Seeds of wheat, maize and others are broadcast on soil to get new plants. b. Seeds of rice and of many garden flowers are grown in a nursery and tiny plants are transplanted in the fields.
4. Plants require soil suitable to their growth.	a. Soils are of different kinds such as sand, clay and loam b. Different soils have different capacities to hold water. c. Soil contains minerals. d. Plants require minerals for growth. e. Different plants require certain minerals in different amounts. f. The minerals found in organic matter are more readily available to plants than those present in clay and sand.
CLASS IV	
1. The plant makes its own food from simple materials.	a. The green parts of the plant (leaves and in some cases stems) prepare sugar from carbon dioxide and water.

Major Concepts	Sub-concepts
	b. The leaves take in carbon dioxide from the air. c. The water necessary for making sugar is absorbed through the roots d. Most of the cells of the leaf contain a green pigment called chlorophyll. These cells manufacture sugar using the energy from sunlight.
2 Grasses are the prime sources of food for man and animals.	a. Some grasses produce edible seeds and are called cereals Paddy, wheat, maize and millets are cereals. b. Sugarcane is the stem of a grass. c. Grasses are used as fodder for animals.
3. Grass plants are useful to man in many other ways.	a. Grasses are used for making paper. b. Grasses such as bamboo, reed, and millets are used as building material. c. Grass lessens the carrying away of soil by wind and rain.

CLASS V

1. Many plants reproduce by germination of seeds.	a. A plant produces many seeds. b. All seeds cannot germinate (i) Some are too immature to germinate (ii) Some are spoiled by natural agencies like water, frost and disease. c. All seeds that can germinate do not always germinate. (i) Some seeds are destroyed by animals (ii) Some do not find suitable conditions for germination.
2. Certain conditions favour germintion of seeds. For germination a seed requires	a. *water.* b. *air.* c. *warmth.*

Major Concepts	Sub-concepts
3. Dispersal of seeds is necessary to provide essential conditions for the growth of new plants and continuance of the species.	a Many seeds that germinate do not develop into plants. b. Plants require *air* for growth. c. Plants require *sunlight* for growth. d Plants require *water* for growth. e. Plants require *minerals* for growth. f. In one and the same plot all these conditions may not be available and hence there is need for the seed to be dispersed widely.
4. Seeds are adapted for dispersal. In this way they are carried to new localities.	a. Some seeds have appendages which float them in air. b. Some seeds are formed in pods which crack on drying and throw the seeds further away. c. Some fleshy fruits have seeds which are not digested or not eaten. These seeds are scattered by man and other animals. d. Some seeds have hooks or thorns which stick to the body of animals and are carried far by them. e. Some seeds float and are carried away by water currents.
5. Different crops require different conditions for their growth.	a. Certain crops grow better in a well aerated sandy soil (groundnut, onions, potatoes). b. Certain crops grow better in wet clayey soil (rice, jute). c. Vegetable crops grow better in a soil rich in organic matter. d. Melons grow best on the sands of river beds. e. Tea and coffee plants grow best on moist slopy hill sides. f. Potatoes, cabbage, cauliflower, and peas require a cool climate. They are grown in winter on plains and in summer on hills.

Major Concepts	Sub-concepts
6. Crops require protection.	a Crops need protection from many animals that cause damage to them for example, insects, rodents, birds, goats, cattle and jackals. b. Fungi, bacteria and viruses also damage crops. Crops are protected by planting disease resistant varieties or by using fungicides c. Seeds are preserved by drying and storing in containers which are water-proof and vermin proof d Storage bins (*khatti*) are sealed to keep out insects and vermin.

CLASS VI

1 Common plants reproduce by seeds	a. Plants have flowers which develop into fruits and seeds. b Seeds contain tiny dormant plants. They can remain dormant for many seasons. c. Seeds grow into new plants on getting suitable conditions.
2. The different parts of the flower have different functions.	a. Sepals keep internal parts intact. b Petals attract insects. c. Stamens provide pollen. d. The pistil contains an ovule or ovules which develop into seeds
3. Pollination and fertilization are essential processes in the formation of seed.	a. The transfer of pollen grains from the stamens to the pistil is called pollination b. Pollen grains carry the sperms to the egg cell in the ovules. c. The fusion of the sperm with the egg cell is called fertilization. d. After fertilization ovules mature into seeds and the ovary develops into a fruit.

Major Concepts	Sub-concepts
4. Pollination may be self-pollination or cross pollination.	a. The transfer of pollen from the stamen to the pistil of the same flower is self-pollination. b. The transfer of pollen from the stamen to the pistil of another flower is cross pollination.
5 Cross pollination is accomplished in several ways	a. Wind may carry the pollen (maize, bajra, pine) b. Wind pollinated flowers have special adaptations. (i) Pollen is produced in abundance. (ii) Stigmas are usually long and hairy. c Insects, particularly bees, butterflies and moths, may carry the pollen—mangoes, peas, hibiscus, lotus. d. Insect pollinated flowers have special adaptations. (i) The petals are coloured. (ii) They usually have nectar and are fragrant. (iii) A particular flower may have a close association with a particular insect eg., honey bee with sweet pea and *Salvia*. e. Special devices in many flowers prevent self-pollination. (i) Flowers may be unisexual (gourd) palm, maize, (date). (ii) Stamens and pistil mature at different times (aster, *Salvia*). (iii) Location of stamens does not favour self-pollination (primrose.)
6. While flowering plants are generally propagated by seeds, some are easily propagated by vegetative means.	a. Certain plants are propagated from cuttings (sugarcane, sweat potato, tapioca and rose). b. Certain plants are propagated by grafting (citrus, mango).

Major Concepts	Sub-concepts
	c. Certain plants are propagated by budding (rose, mango, orange, apple). d. Certain plants are propagated by layering (mint, lemon). e. Certain plants are propagated by tubers, corms, bulbs or root-tubers. (potato, banana, ginger, onion, dahlia). f. Certain plants are propagated by leaves (*Bryophyllum*, *Begonia*).
7. Non-flowering plants are reproduced by spores.	a. Certain plants do not bear flowers. Ferns and mushrooms are non-flowering plants. b. Such plants bear spores which, like the seed, can lay dormant for long periods. Spores are light and are readily blown by the wind. c. The spores germinate under suitable conditions and ultimately form new plants.

CLASS VII

1. The structure of the root is adapted to its many functions.	a. Roots anchor plants (fibrous and tap roots). b. Roots absorb water and minerals Absorption takes place through 'root hairs near the tips of the roots. c. Food accumulates in certain roots (tapioca, radish, carrot, beet and sweet potato).
2. The structure of the stem is adapted to its many functions.	a. Stem supports and bears the leaves. b. The transport of materials between the leaves and the roots takes place through the stem. c. Food accumulates in certain stems (sugarcane, potato). d. The stems of certain plants can be used for vegetative propagation (sugarcane, potato, doob, grass.)

Major Concepts	Sub-concepts
3. The structure of leaves is adapted to their specialized functions.	a. The main function of the leaf is photosynthesis. Other functions are respiration and transpiration. b. The under surface of the leaf contains more numerous minute openings called stomat through which water vapour and air pass. c. Veins carry water to the leaf, and food from the leaf to the other parts of the plant d. A waxy coating prevents excess of loss of water. This is specially marked in plants growing in dry regions. e. Plants growing where rainfall is heavy have pointed leaves (drip tip) and waxy coatings which shed water readily.

CLASS VIII

1. Crop yield can be improved by various methods.	a Plant and animal manures are used to increase the fertility of the soil. b. A seed bed should be carefully prepared by deep ploughing and harrowing. c. Lime is added to neutralize acidity where needed. d. Chemical fertilizers are used to enrich the mineral content of the soil. e. Healthy seeds of a productive variety give a better yield. f. Seeds should be planted properly spaced and at the right depth. g. Stirring the soil by cultivation aerates it, increases the growth of nitrogen fixing bacteria, and kills weeds. h. Rotation of crops and green manuring improve yields. i. Spraying with certain chemicals protects plants from disease-producing insects, fungi and microbes.

Major Concepts	Sub-concepts
2. Science is used to improve the varieties of plants.	a. Seeds of the best plants are selected for use for raising the next crop. b. Plants with desirable qualities are crossed. The offsprings are selected and tested for desirable qualities c. Productive varieties with desirable qualities may be multiplied by their seed or by vegetative methods.
3. Plants need certain mineral salts for healthy growth	a. Certain minerals are needed in larger quantities, namely, compounds of nitrogen, phosphorus and potassium. b. Certain minerals are needed in traces only, namely, compounds of iron, manganese, magnesium, boron and zinc.
4. Leguminous plants increase the nitrogen content of the soils.	a. Leguminous plants develop certain structures on their roots, called nodules. b. These nodules contain bacteria which can convert atmospheric nitrogen into nitrogen compounds. c. When the leguminous plant dies, these nitrogen compounds are added to the soil. d. Leguminous plants and seeds are rich in proteins and so are valued as food for man and other animals.

UNIT X

ANIMAL LIFE

Major Concepts	Sub-concepts
CLASS I	
1. Animals of various kinds are around us in the environment.	a. There are animals like cat, dog, cow and buffalo around us. b There are birds like chicken, crow, duck and sparrow around us. c. There are insects like butterfly, mosquito, house-fly, ant and bee around us. d. Fish and frogs are seen in water. e. Lizard and snakes are seen in houses and gardens. f. Many other animals live on land and in water.
2. Each animal has its own external characteristics and size.	a. Animals like cow, horse, cat, buffalo, dog and lizard have four legs b. Birds like chicken, crow and sparrow have two legs, two wings, feathers and a beak. c. Most insects like butterfly, moth, fly, and bee have six legs, and wings. d. A frog has two pairs of limbs to swim and to jump about. e. Fish have fins with which they swim. f. Some animals are big and some are small.
3. All animals require food and shelter.	a Some animals eat grass and fodder. b. Some animals eat grains. c. Some animals eat insects. d. Some animals eat other animals. e. All animal require shelter from sun, cold, rain and enemies. f. Birds make nests.

Major Concepts	Sub-concepts
CLASS II	
1. Domestic animals serve us in many ways	a. The cow, the buffalo and the goat give milk. b. The hens and the duck give eggs and chicken. c Sheep give wool. d. The ox, the horse, the camel and the buffalo carry loads and are used for farming. e. The dog watches homes and fields. f. The meat of certain animals, sheep, goats, pig and birds is cooked as food. g. The cat keeps away the mice. h. The skins of animals are useful as leather. i. The excreta of animals is good manure. j Dung should not be used as fuel.
2. Many animals are wild.	a. Birds, reptiles and other animals may be wild. b. Man domesticates only those animals that are useful to him
3. Some wild animals make their own natural homes.	a. Many of the wild animals depend upon natural shelters for their homes. b. Birds make their nests in trees or protected places. c. Rats, mice, ground hogs, moles etc. generally dig holes in the ground to live in d. Snakes and rabbits live in the holes dug by other animals
4. Wild animals vary in size.	a. Elephants are huge in size. b. Birds, rabbits, squirrels, reptiles, butterflies and ants are small in size.
5. The food habits of wild animals differ.	a. Some wild animals eat only plants. b. Some wild animals kill other animals for their food.

Major Concepts	Sub-concepts
	c. Some animals like bear, rats and some birds like crow eat both animals and plants.
	d. Some wild animals like fox, jackal and vulture eat the remains of dead animals.
CLASS III	
1. Animals require different types of food for proper growth.	a. Food requirement of animals is akin to that of man. It should contain (i) body builders (ii) energy givers (iii) mineral salts.
	b. The staple food of many animals is obtained from grass plants.
	c. The food of some animals is mainly flesh
	d. Different animals require different quantity and types of food depending upon the use to which the animal is put.
	e. To get maximum use of animals like cow, ox, buffalo, they have to be given good and sufficient food.
	f. Proper nourishment has to be given to the hen so that she lays more eggs.
2. Animals eat in different ways.	a. Some animals tear and swallow.
	b. Some animals first nibble and then chew the cud.
	c. Some animals lick liquid food.
	d. Some animals suck liquid food.
	e. Some animals swallow the whole food.
3. Domestic animals require care.	a Proper shelter away from human dwellings should be provided to domestic animals.
	b. Clean drinking water should be provided to animals for healthy growth.
	c. Animals should be properly groomed and cared for so that they give maximum service
	d. Sick animals should be treated.

Major Concepts	Sub-concepts
4. The structure of birds is suited to their flying habits.	a. Some birds fly at great heights and some fly at lower heights. b. Some birds fly long distances and some birds fly short distances to get food. c. The wings and tail feathers enable bird to fly. d. The hollow bones make the flight easier
5. The structure of aquatic birds is suited for swimming and flying.	a. Webbed feet serve as paddles. b. Birds that swim have oil over the surface of the body, so the wings do not get wet.
6. The beaks and feet of birds are suited to the food they catch and eat.	a The beaks of birds are suited to the method of catching and eating food b. The feet of some birds are suited for holding prey, walking on marshy land, wading through water, swimming in water or perching on trees or where they find food
7 Birds have different nesting habits	a. Most birds build their own nests. b. Birds build nests at different places. c. Birds build nests using different materials.
8. Birds care for their young.	a. Most birds tend their young. b. The young ones are cared for till they learn to fly

CLASS IV

1. Animals reproduce their kinds.	a. Some animals give birth to young ones. b. Some animals like birds lay eggs which hatch into young ones. c. Insects lay eggs which pass through various stages before the mature insect is formed.

Major Concepts	Sub-concepts
	(i) Some insects like the grass-hopper pass through a series of moults. (ii) Others like the butterfly pass through four stages in their life cycle.
2. Some animals care for their young ones while others do not.	a. In some animals the mother suckles the young ones. They are called mammals. b. Birds tend their young ones till they learn to fly. c. Most fish, frogs and reptiles do not care for their young ones.

CLASS V

1. Different kinds of animals are found in different types of surroundings.	a. There are big and small animals, birds, insects, reptiles, worms, mammals, amphibians and fishes in their respective environments. (i) Some live on land (ii) Some live in water (iii) Some live on land and in water. (iv) Some live on the ground and also in the air. b Different animals have different food habits and different types of homes.
2. Different kinds of animals have developed different types of limbs	a. Man, the most developed of animals, uses the front limbs (hands) for catching, holding and doing various kinds of work. b. Monkeys and some other animals can also use the front limbs for procuring food and for catching and holding. c. Birds move on two legs and fly with wings. Some birds can move on land, swim in water and fly in the air. d. Some animals, called reptiles may or may not possess limbs, but all of their crawl along the ground.

Major Concepts	Sub-concepts
	e. Insects move on legs on the ground and most of them have wings also to fly.
	f. Fish swim with fins.
3. Certain animals possess special breathing mechanisms.	a. Most land animals like mammals, birds and lizards breathe by lungs.
	b. Frog breathes through its skin besides its lungs.
	c. Fish breathes through gills.
	d. Insects breathe through air tubes in their body.
4. Certain mechanisms enable animals to procure their food.	a. Butterflies have a long tongue.
	b. Frog has a long slimy tongue.
	c. Cranes which feed in shallow water have long legs, and long beaks.
	d Woodpecker has a strong pointed beak to catch insects from the tree trunks.
	e. The eagle has strong claws to catch mice and small animals.
5 Migration enables animals such as some birds and certain fishes to find suitable conditions for living, food and reproduction.	a. Birds avoid unfavourable weather conditions by migration.
	b. Certain birds find suitable nesting places by migration.
	c. Migratory birds have strong wings.
	d. Some fish like eels and salmon migrate long distances to lay eggs in a particular environment

CLASS VI

Earthworm

1. The earthworm is a nocturnal animal living in moist soil.	a. The earthworm seldom comes out in the day except in the rains when its hole is filled with water.
	b. The earthworm has a mouth and a muscular ringed body.
	c It has no eyes or ears.
	d. It exchanges gases through its moist skin.

Major Concepts	Sub-concepts
2. Its body parts are adapted to its food habits.	a. It has a pointed mouth by which it digs the earth to eat and burrow in its home. b. It eats earth and rotten animal and vegetable matter in the soil. c The excreta is passed out in the form of pellets at the opening of its burrow.
3. The activities of the earthworm benefit the farmer.	a. Vast numbers of earthworms aerate the soil by their burrows b. The soil is turned over by the earthworm. c. The excreta of the earthworm is a good manure.
Fish	
1. The body parts of the fish are adapted for living in water.	a. The body of a fish is streamlined and is suited for movement in water. b. The gills of fishes are adapted for breathing in water. c. The mouth parts of a fish are suited to its food habits.
2 Fishes are a source of food to man and animals.	a. Fish is a good source of animal protein food for man. b. Fishes are a source of food for some birds and water animals c. Fish waste is a good manure. d. Cod and shark liver oils are good sources of vitamins A and D.
Frog	
1. The adult frog lives both on land and in water	a. It can use its limbs to jump on land and also to swim in water. b. It feeds on insects which are found mostly on land. c. It jumps into water for protection. d. It breathes air into lungs by taking air into its mouth through its nostrils and swallowing it. It also exchanges gases through its moist skin.

Major Concepts	Sub-concepts
2. The eggs develop through a series of changes into the adult frog.	a. It lays eggs in water. b. The eggs hatch into tiny tadpoles. c. The tadpole swims by its tail d. It exchanges gases through its skin and gills. e. It feeds on tiny vegetable matter in water and grows rapidly. f. It develops legs and loses its tail. g. As it becomes an adult, its feeding, breathing and swimming habits change.

CLASS VII

1 The structure of the mouth is fitted to the food habits of the animal.	a. The cow and the horse do not possess canine teeth. b. The cow has cutting teeth on the lower jaw. The upper jaw has only a stiff gum. It feeds by wrapping its tongue around the grass and then cutting the grass with its lower teeth. c. The horse has cutting teeth on both jaws. d. The dog and the cat have well-developed canine teeth e. The plant-eating animals have well-developed molars.
2 The digestive organs of herbivorous animals are adapted to their food habits	a. The herbivorous animals have a comparatively long intestine in proportion to their body length. b. Some herbivorous animals have a pseudo-stomach in which they store food when swallowed and later chew the cud.
3. Reptiles crawl along the ground with or without limbs.	a. Reptiles are cold blooded vertebrate animals. b. Common lizards, crocodiles and tortoises crawl with the help of four limbs.

Major Concepts	Sub-concepts
	c. Snakes crawl without any limbs by the movement of body muscles, ribs and scales. d Reptiles usually feed on other animals.
4. Snakes form a separate group of reptiles.	a. Certain snakes are poisonous. They can be distinguished from non-poisonous snakes by certain characteristic features. b. The snakes have an elastic binding of their jaws which enables them to swallow a whole animal by stretching the jaws. c. The tongue of the snake is used as a sense organ. d The poison of a poisonous snake is injected by a pair of grooved or hollow fangs which receive the poison from the poison glands. e. The bite of a poisonous snake may be fatal and requires immediate first aid and treatment.
Reproduction	
1. Birds, reptiles, amphibians, fishes, insects and many other animals lay eggs.	a. A fertilized egg is the first stage in the process of reproduction. b. The fertilized egg develops into an embryo. c. An egg contains food-material for the growth of the embryo. d The eggs of birds, reptiles and fish directly hatch into young ones. e. The eggs of insects and amphibians hatch into larvae or tadpoles which again pass through several stages before the adult stage is reached. f. Eggs may be hatched artificially in incubators
2. Mammals give birth to young ones which suck milk from their mother.	a. The fertilized egg develops within the womb of the mother for some time. b. A placentum carries food from the mother to the growing embryo.

Major Concepts	Sub-concepts
	c. The young one after birth depends on its mother's milk for nourishment till it is able to find food independently.
CLASS VIII	
1. Animals can be classified broadly into vertebrates and invertebrates	a Animals which possess a back-bone as a chief support to the skeleton are called vertebrates b. Animals without back-bone are called invertebrates
2. Vertebrates can further be classified into mammals, birds, reptiles, amphibians and fishes.	a. Mammals are vertebrates which are warm-blooded, have hair and lungs, breathe air, and feed milk to their young ones. b. Birds are vertebrates which are warm-blooded, have feathers and lungs, breathe air, have beaks and no teeth, two wings and two feet c. Reptiles are vertebrates which are cold-blooded, are covered with scales, and which breathe air through lungs. d Amphibians are vertebrates which are cold-blooded, and have a skin without scales, and live a part of the time on land and a part in water e. Fishes are vertebrates which are cold-blooded, have fins and scales, and breathe through gills.
3. Invertebrates can be classified into several groups.	a. Insects have six legs, one or two pairs of wings, three body parts, and two feelers. They breathe by air tubes (trachea), and lay eggs. b. Snails live in water and have strong shell for protection. Oysters are sea-animals living in shells One type of oyster produces pearls. c. Spiders and crabs have eight legs for locomotion and two pincers for catching and cutting. d. The earthworm is a segmented, muscular ringed worm.

UNIT XI

SCIENTISTS AT WORK

CLASS I

Major Concepts	Sub-concepts
1. Boyhood stories of scientists like Newton and Galileo show what young scientists are like.	a Scientists are curious about things. b. They make careful observations. c They do experiments to satisfy their curiosity and to get answer to their problems.

CLASS II

1. Boyhood stories of Faraday, Edison and James Watt show what young scientists are like.	a. Scientists are curious about things. b They make careful observations. c. They do experiments to satisfy their curiosity and to get answer to their problems.

CLASS III

1 Stories of scientists like Jenner and Pasteur who discovered ways to keep individuals and communities healthy show how scientists work.	a Vaccination prevents small pox. b Diseases are caused by micro-organisms. c Pasteurization of milk prevents growth of microbes

CLASS IV

1. Scientists like Koch, Funk, Reed and Ross discovered how to keep individuals and communities healthy. They show how scientists work.	a Certain bacteria are specific causes of some diseases. b. Malaria is caused by a minute micro-organism which is spread by a particular kind of mosquito. c. Yellow fever is caused by a microbe which is spread by a different kind of mosquito d. If the specific cause of a disease or its carrier is known, it is possible to control it. e. Vitamins are needed in minute quantities to keep healthy and resist diseases.

Major Concepts	Sub-concepts
CLASS V	
1 Scientists like Edison, Marconi and Raman work ceaselessly to test their ideas.	a. They are curious about things. b They make careful observations c. They try to account for phenomena observed and predict the possible consequence of their explanation in all kinds of situations. d. They devise experiments to see if the predictions are true. e. They accept their explanation as true if their predictions can be checked experimentally ; they reject their explanation if their predictions are not borne out. f They are aware of the assumptions they have made in drawing their conclusion g They discover new problems as they experiment to account for the phenomena observed and they repeat the whole process over again. h. Good scientists are not discouraged by their failures, but continue to work.
2. Scientists learn from other scientists.	a In trying to account for a phenomenon a scientist always takes into account what is already known about it previously. b. Scientists publish their findings in well established journals together with an account of how they did it for others to know.
CLASS VI	
By their work scientists like Priestley, Lavoisier, Pasteur and Harvey inspire us to achieve our goals.	Scientists often held convictions that were not popular at the time, e.g , Pasteur's germ theory of disease, Harvey's theory of blood, the Raman effect, Galileo's explanations of gravitational pull, Priestley and the phlogiston theory, Copernicus and the Geocentric theory of Universe

Major Concepts	Sub-concepts
	b. The accomplishments of scientists often appear like a chain reaction in thinking, i.e. one thing seems to lead to the next. c. Madam Curie made an invaluable contribution by her discovery of radium and her work on radioactivity
2. Scientists in all ages have been interested in improving conditions of man's life, for example, Pasteur with his germ theory of disease and Fleming with his discovery of antibiotics.	a. Pasteur improved man's living conditions by his discovery of the germ theory of disease b. Fleming helped human welfare by his discovery of penicillin and antibiotics.

CLASS VII

1. The achievements of a scientist like Copernicus, Dalton or Kepler are often in many fundamental fields.	a. A scientist works primarily to find out the nature of things. b. Scientific truths have replaced superstitions and dogmas.
2. Often a pressing problem drives scientists in several parts of the world to seek a solution.	a. The problem of producing electricity was studied by many scientists at the same time—Oersted, Faraday, George Ohm, Joseph Henry, Andre Ampere. b. Experiments of several scientists such as Eikman, Hopkins, Funk, McCollum resulted in the discovery of vitamins c. Wireless waves were discovered by both Marconi and J.C. Bose. d. Theories of evolution were developed by Darwin, Wallace and Lamarck.
3. Scientists pool and share their knowledge through National and International agencies.	a The International Geo-physical Year was celebrated in 1959 with the cooperation of all major nations of the world to investigate the air, sea, weather, the geophysical aspects of the earth's interior, etc., by international collaboration.

Major Concepts	Sub-concepts
	b. Unesco is an agency for international exchange of information about science and its many applications.
CLASS VIII	
1. The contribution of scientists like Shapley and Eddington greatly expanded man's knowledge of the universe.	a. Many discoveries led to the knowledge about the vastness of the universe. b. Better tools and improved methods of investigation like spectrograph, photography, telescopes, and radiotelescopes have given man a wider and deeper knowledge of the universe.
2 Some scientists make spectacular discoveries that entirely alter the ways of thought and life.	a. Scientists like Faraday and Marconi made fundamental discoveries which made possible the present day use of electricity and radio in everyday life. b. The discoveries of Einstein, Rutherford Bohr and Fermi have given a completely new concept of matter, energy and structure of atom.
3. All scientific discoveries have not yet been made.	a. Each new theoretical concept, discovery or invention opens news opportunities for further investigations, for example, DNA. b. Empirical studies and practical problems in the application of science have led to new discoveries

UNIT XII

MEASUREMENTS

CLASS III

Major Concepts	Sub-concepts
1. Length is measured in metres, centimetres and kilometres.	a. Metre is the unit of length. b. 1/100th part of a metre is a centimetre c. 1/10th of centimetre is one millimetre. d. 1000 metres make one kilometre.
2. Weight is measured in grams, kilograms, quintals and metric tons.	a. A kilogram is equal to 100(grams. b. 100 kilograms make one quintal. c. 1000 kilograms make one metri' ton.
3. Time is measured in seconds, minutes, hours, days, weeks, months and years.	a. A day is the time taken by the earth tc rotate once on its axis. b. An hour is 1/24th of a day. c. The year is the time taken by the earth to travel once around the sun. It is approximately equal to 365¼ days. d. A month is approximately the time that the moon takes to travel round the earth. It is approximately 30 days.

CLASS IV

1. Surface is measured in square metres or square centimetres.	a. The measure of surface bounded by sides is known as area. b. The area of a rectangular surface is given by the product of its length and breadth. c. The area of a square is given by squaring any side.

Major Concepts	Sub-concepts
	d. A square metre is the measure of a square surface having each side equal to a metre in length. e. A square centimeter is the measure of a square surface having each side equal to a centimetre. f. Ten thousand square centimetres make one square metre.
2. Space is measured in cubic centimetres and in litres.	a. A cubic centimetre is the measure of the space occupied by a cube each side of which is 1 cm. long. b. A cubic metre is the measure of the space occupied by a cube each side of which is 1 metre long. c. One thousand cubic centimetres make one litre. d. A cubic centimetre is also equal to a millilitre.

UNIT XIII

OUR UNIVERSE

CLASS I

Major Concepts	Sub-concepts
1 We see the sun, moon and stars in the sky.	a. The sun is seen during the day. b. The stars are seen at night. c. The moon is seen at night and at times during the day also.
2. The sun rises and sets everyday.	a. The sun rises everyday in the same direction (East). b. The sun sets everyday in the same direction (West). c. The sun rises and sets everyday causing day and night.
3. The appearance of the moon changes from day-to-day.	a. The moon appears round on certain evenings (Full moon). b. The moon appears crescent-shaped on certain evenings (New moon). c. The shape of the moon appears to be semi-circular on certain evenings.

CLASS II

1. The sun lights and warms the earth.	a Days are bright and nights are dark. b. Days are warm and nights are cool.
2. The sun is a very large hot ball or sphere.	a The sun consists of white hot glowing gases. b. The sun appears small because of its great distance from the earth. However, the distance across the face of the sun is 100 times the diameter of the earth.
3. When light is obstructed, shadows are formed	a. When we walk in light, we see our shadow. b. Objects cast their shadows.

Major Concepts	Sub-concepts
4. Shadows change in length and direction.	a. Shadows are longer in the morning and in the afternoon than at mid-day. b. Shadows of an object are formed in the direction opposite to the source of light.
CLASS III	
1. The earth is a big round ball.	a. It is so large that it appears flat. b. People can travel around the earth.
2. The earth rotates causing night and day.	a. The side of the earth facing the sun is lighted. b. The side of the earth away from the sun is dark. c. Sunlight moves from east to west along the earth's surface, because the earth rotates from west to east : (i) While people in India are having day, those in America are having night and vice versa. (ii) The clock in East Pakistan is half an hour faster than the clock in India. Likewise the clock in West Pakistan is half an hour slower than in India.
3. The moon gets its light from the sun.	a. Moonlight is reflected sunlight : (i) The lighted side of the moon is towards the sun. The rest of the moon appears dark. (ii) At the time of the new moon, the dark portion of the moon is also dimly visible by reflected 'earth light'—sunlight reflected from the earth to the moon, and then 'moon light' as the light is again reflected to the earth. b. A full moon is always on the side of the earth opposite the sun ; a new moon is on the same side of the earth as the sun.

Major Concepts	Sub-concepts
CLASS IV	
1. The earth is one of the planets going round the sun.	a. A planet is a body that revolves round the sun. b. Each planet travels on its own path called an orbit. c. There are nine planets.
2. The earth is very hot inside.	a. There is great pressure inside the earth b. Volcanoes erupt at weak portions of the earth's crust because of excessive pressure and temperature inside the earth.
3 The sun is a hot glowing mass	a The surface temperature is hotter than a carbon arc-light or furnace. b. The sun is warmed by atomic fires.
4. There are billions of billions of stars in the sky.	a. Stars are all around us all the time—but the light of the sun makes them invisible during the day. b. Stars are hot glowing masses c. All stars emit heat and light. d. The sun is the nearest star to the earth. e. Some stars occur in groups—called constellations.
5. The earth revolves round the sun on an axis tilted with reference to the plane of the earth's revolution round the sun.	a. The earth completes one revolution round the sun in a year. b. The axis of the earth is tilted with reference to the plane of the earth's revolution round the sun. c. Seasons are caused by the revolution of the earth round the sun with its axis inclined to the plane of its revolutions : (i) The sun's rays are more directly overhead in summer than in winter —hence are more intense. (ii) There are more hours of daylight in summer than in winter

Major Concepts	Sub-concepts
	d. Sunlight received by the earth in places near the equator does not vary much throughout the year.
6. Changes in seasons affect the life of people, plants and animals.	a. People use different clothes in different seasons. b. People use different devices to keep their homes warm in winter and cool in summer.

CLASS V

1. The moon is a ball of barren rock slightly over one-fourth the diameter of the earth.	a The moon has no air or water. No living things exist on the moon. b. The darker, irregular spots seen on the moon are really mountains and craters, and the lighter areas are vast plains.
2. Tides are caused by the gravitational attraction of the moon and the sun pulling on the water on the earth.	a. The sun is much farther away from the earth, hence the gravitational attraction is less than that of the moon. b. The moon's gravity pulls the nearest water a little away from the earth causing a high tide. c. At the same time there is a high tide built up on the opposite side of the earth from the moon. The moon apparently pulls the solid earth away from water on the opposite side. d. There is a high tide every twelve hours and twenty four minutes.
3. An eclipse takes place when the moon and the earth get in a direct line with the sun.	a. Sometimes the earth passes between the moon and the sun in such a way that the earth casts a shadow on the moon. When this happens, a lunar eclipse occurs. b. Sometimes the moon passes between the earth and the sun in such a way as to cast a shadow on the sun. When this happens a solar eclipse occurs.

Major Concepts	Sub-concepts
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Major Concepts	Sub-concepts
	c. There may be a partial eclipse or a total eclipse depending on whether some or all light is cut off. d. Lunar eclipse occurs only on a full moon night. e. A solar eclipse occurs only on a new-moon day. f. Eclipses do not occur on all full moon or on new moon days.
CLASS VI	
1. The solar system includes the sun and all the bodies that revolve around it	a. There are nine known planets. b. Each planet revolves in its own orbit around the sun and also rotates on its axis. c Objects revolving around planets are called moons or satellites. d. There are also asteroids, meteors and comets in the solar system. e. Different planets are of different sizes. f. The planets are all made of about the same materials as the earth. g. The planets shine by reflected light from the sun
2. The moon travels round the earth as the earth travels round the sun.	a. The same face of the moon is always visible from the earth The moon rotates once on its axis as it revolves around the earth. b. The period of one rotation of the moon on its axis is about 27⅓ days. This period is the same as its period of revolution around earth. c. The time from one new moon to the next is about 29½ days. It must turn more than one complete revolution to reach the next new moon position between the earth and the sun, for both the earth and the moon have moved eastward along the elliptical orbit.

Major Concepts	Sub-concepts
	d. The phases of the moon change as the moon revolves from west to east around the earth.
	e. The moon travels 12 degrees eastward across the sky every day in its journey round the earth.
	f The earth rotates once around (360°) eastward each day. This is more than the moon's eastward motion as it revolves round the earth Therefore the moon sets in the west. Actually the earth rotates slightly more than once around each day, (about 361°), for it also turns as it goes round the sun.
3 A satisfactory mental model of the solar system must account for many observable phenomena	a. By building a mental model of the solar system with the earth spinning on its axis, the moon going round the earth, the earth and the moon going round the sun, the earth's axis inclined to the plane of its revolution around the sun, we can account for such observable phenomena as : (i) day and night. (ii) sunrise in east, sunset in west. (iii) seasons. (iv) phases of the moon. (v) apparent motion of the stars. (vi) forward and retrograde motion of planets as they revolve round the sun.
	b. It would be difficult to account for the wind belts of the earth, or for the ocean currents if the earth did not rotate.

CLASS VII

1. The planets appear to migrate among the stars.	a. The planets move from west to east as they revolve around the sun.

Major Concepts	Sub-concepts
	b Due to the earth's shift in position as it revolves around the sun, the planets appear to move westward among the stars periodically—that is, to show retrograde motion.
	c. Due to the earth's shift in position as it revolves around the sun, and due to the fact that the intensity of light varies inversely as the square of the distance from the source, the planets appear brighter at the time they are showing retrograde motion.
2 The size and distance of objects may be measured indirectly. Parallax is the basis of all such measurements.	a. The height of a tower may be measured by comparing the length of its shadow with the length of a shadow of a pole of known length. The height is calculated as follows:
	b. Height of tower/Height of pole-Length of shadow of tower/Length of shadow of pole You can measure the circumference of of the earth as Erastosthenes did in 650 B.C. He found that the angle of the sun's rays, which were directly overhead at Syene, Egypt, came at an angle of 7.2 degrees at Alexandria 490 miles north of Syene. From this he reasoned that the distance of 490 miles between Syene and Alexandria represented an arc of a circle with the earth at its centre, and that this arc represents 1/50 of the circumference of a circle (360/7.2=50). Therefore the circumference =50 x 490 miles= 24,500 miles.
	c. The apparent change of position against background objects is called parallax (i) As you move along a highway, the trees near you seem to shift with respect to the trees in the distance.

Major Concepts	Sub-concepts
	(ii) A pencil held at arm's length appears to shift its position with respect to the opposite side of the room when viewed first with one eye and then with the other.
	b. Using parallax, the distance across a field may be measured. This can be done by staking out a base line and sighting across the field from each end of the triangle. Then a similar triangle is constructed at one end of the base line, and the distance calculated as follows: Distance across field/Length of corresponding side of triangle-Length of base line/Length of base of triangle. Having calculated the distance across the field, it is possible to determine the size of an object using similar triangles.
	c. The distance to the moon and the planets can be estimated by triangulation
	d. After the distance to the moon is calculated, the diameter of the moon can be estimated by triangulation.
	e. The distance to the moon can also be measured by the echo of a radar beam.
CLASS VIII	
1. The universe includes everything that exists. It is so vast that its limits are unknown. The solar system is located in one of the arms of a local 'pin-wheel' of stars, called a galaxy. Within this galaxy are billions of stars grouped in various ways.	a. Stars are far away suns. They are huge balls of glowing gases.
	b. Stars differ much in size, colour, and temperature.
	c. The sun is a middle-sized star.
	d. Stars are so far away that even though they are moving rapidly, they seem to be in fixed positions.
	e. Stars have been grouped into handy patterns called constellations. Man uses constellations to guide his movements at night, and to find specific objects in the sky.

Major Concepts	Sub-concepts
	f. Stars may be located by knowing the direction and the altitude in the sky. g. Stars are located precisely by a system of coordinates similar to latitude and longitude, called right ascension and latitude. h. A large proportion of the stars in the sky are double stars or clusters of several stars. i. Millions of stars may be grouped into a cluster called a globular cluster and appear as a single star, eg., star cluster in the constellation Hercules. j. There are many nebulae in the sky; some are dark nebulae and appear as black holes in the sky, others are bright. The bright ones consist of scattered white-hot glowing gases.
2. The stars are so far away that their distances are measured in light-years.	a. A light-year is the distance light travels in a year. Light travels 30 crores metres (186,000 miles) in a second, and nearly 60 lakhs of crores kilometres (6 trillion miles), in a year. b. The nearest star to us, excluding our sun, is approximately 4.3 light-years distant.
3. The distances of some of the stars from the earth have been measured.	a. The distances to the nearest stars have been measured by parallax, by their displacement among the distant stars when the earth is on opposite sides of its orbit. The base line for this triangulation is 186 million miles long. b The brightness of the nearest stars has been determined by measuring the apparent brightness at the earth's surface and then applying the inverse square law to their known distance to determine their actual brightness.

Major Concepts	Sub-concepts
	Having done this, it then became possible to measure the actual brightness directly by means of a spectroscope, for it was found that stars of a given brightness produced a particular spectrum.
	c. It is then possible to measure the distance of more remote stars by measuring their actual brightness with a spectroscope and their apparent brightness at the earth's surface, and applying the inverse square law to determine the distance.
	d. Other indirect means have been used to measure the distance of remote galaxies, but these means are all based upon the first measurements made of parallax.
4. Stars are arranged in galaxies and systems of galaxies.	a. The galaxy in which our earth is located is an enormous flattened disc extending 30,000 light-years across one diameter and 100,000 light-years across another.
	b. Our galaxy is one of many similar galaxies:
	i) Andromeda is the nearest of the great spiral nebulae. It is a member of a local group of 17 galaxies to which our galaxy belongs. Its probable distance is 2 million light-years. Its diameter is about 150,000 light-years.
	ii) Hundreds of galaxies are visible with a moderate-sized telescope. They are grouped in clusters of galaxies. Within the area of the big dipper alone, an area encompassing only 1/2000 of the

Major Concepts	Sub-concepts
	whole sky, there is a cluster of more than 300 such galaxies. iii) Astronomers estimate that about one trillion galaxies lie within the range of our largest telescopes. Approximately 17% of these are classified as elliptical, 80% as spiral and 3% as irregular.
5. Motion is everywhere in the universe. One riding on the surface of the earth, simultaneously experiences these and many other motions such as—	a. spinning on axis at 1,000 miles per hour. b. whirling around the sun at 20 miles a second. c. riding through space on the rim of the milky way at 170 miles a second. d. Experiencing half a dozen other intricate motions such as whirling with the moon around a common centre about 1000 miles beneath the earth's surface, shifting as the earth's axis shifts its axis in short time and long time cycles.
6. There are many hypotheses to account for the origin of the earth.	a. According to Chamberlain and Moulton, the near collision of a passing star pulled away some materials from the sun to form the planets. b. According to Jeans and Jeffries, a star passing close to the sun caused tidal eruptions that sent materials in streaming arms from the sun and set this material revolving like a pin-wheel. This material formed the planets. c. According to Hoyle, the planets and satellites were formed from the fragments of a companion star of the sun which exploded with tremendous force into space. d. If the earth were formed by a unique occurrence or an accident (as in a, b,

Major Concepts	Sub-concepts
	or c) the chances of there being other solar systems like ours are very few, for the distances between the stars is so vast. e. According to Kant and LaPlace, the solar system and the earth arose from a mass of hot swirling gases which condensed to form the sun and the planets. f. According to Von-Weizsacker, the present solar system was originally a disc of whirling gases from which a system of cells was created. The central cell became the sun and the others whirling around condensed to become the planets. g If the earth were formed as above (e and f), astronomers conjecture that there might be a million planets with conditions suitable for life as we know on earth out of a possible billion stars in our galaxy with planets revolving around them.
7. The earth is very old Its age has been estimated in various ways.	a. There are many reasons for believing that the earth is very old such as (i) The rocks show many evidences of change—fossils formed at the bottom of the sea are now found high in some mountains. (ii) Metamorphic rocks, such as mica and schist are found high in many mountains. These schists were formed from clays deposited in shallow seas. Great heat and pressure were required for the formation of the schist. So mountains of sediments must have been laid down on top of the clays and these must have been worn away.

Later the schists must have been raised into mountains. Much time is required for this.

(iii) There is great diversity among the various living things found on the earth. These are believed by many to have evolved from a single form. This would require much time.

(iv) These changes that have taken place can be used to estimate the age of the earth.

b The age of the earth has been estimated from the total depth of the deposits found on the earth. In an out-crop of sediments, the youngest sediments are on top, the oldest are beneath.

(i) The comparative age of deposits found in one location have been determined by such methods as the sequence of strata, the kinds of fossils found (index fossils), and in other ways.

(ii) By coordinating deposits over the earth's surface, geologists have developed a geological column 100 miles in depth. By estimating the average rate at which deposits are made, and then calculating how long it would take to form a layer of sediments a mile deep, an estimate of the age of the earth has been made

c. The age of the earth has also been estimated by other means :

(i) By assuming that to begin with the oceans contained fresh water, and that the salt has been carried into the ocean an estimate of the age of the earth can be made.

Major Concepts	Sub-concepts
	Measurements of the percentage of salt in the ocean, the volume of the ocean and the salt carried into the ocean each year by the rivers have been made. This method shows the earth to be very old.
	(ii) A dependable measure of the age of certain rocks has been made by the ratio of uranium to the particular form of lead formed by the disintegration of uranium. 1/637th of uranium disintegrates to form lead in one crore of years , during the next crore another 1/637 of the uranium disintegrates and so on. Samples of the oldest rocks tested in this way have shown the age of these rocks to be approximately 200 crores of years old The age of the earth must be at least 200 crores old; it is quite certain that the earth is much older than that.
8. To travel in outer space we must first place a vehicle in orbit.	a. Outer space begins where the earth's atmosphere ends.
	b. Rockets are used to put a vehicle in orbit
	c. Much thrust is needed to move the rockets away from the earth.
	d. To place an object in orbit, it must be raised several hundred miles, and then made to move fast parallel to the surface of the earth. It must go fast enough that even though it is freely falling toward the earth, it never reaches the earth—for the earth curves away from it.

Major Concepts	Sub-concepts
	e. When a space vehicle is in orbit, the gravitational force of the earth on the vehicle and its occupants is balanced by the centrifugal force of the vehicle travelling rapidly parallel to the earth's surface. The occupants of the vehicle will experience weightlessness.
	f To re-enter the earth's atmosphere and return to earth, the vast energy expended as the vehicle was thrust into space must be dissipated as heat.
	(i) Highly refractory materials are used in the capsule.
	(ii) The shape of the capsule is designed so dissipate much of the heat in a shock wave.
	(iii) Experiments with high altitude flights are being conducted to build a space ship that can fly back to earth much like a coventional aeroplane.

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